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American Foundryman

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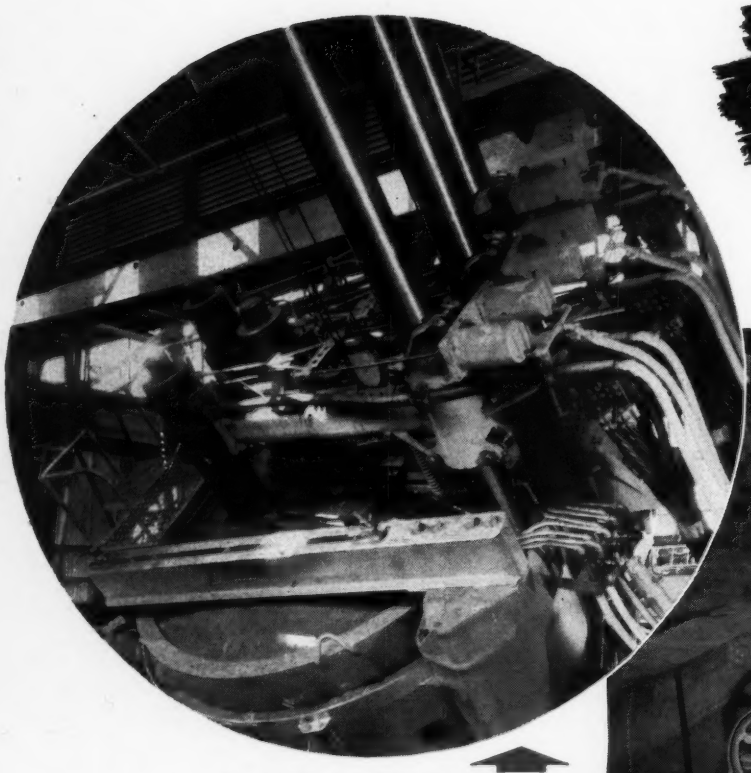
★ THE FOUNDRYMEN'S OWN MAGAZINE

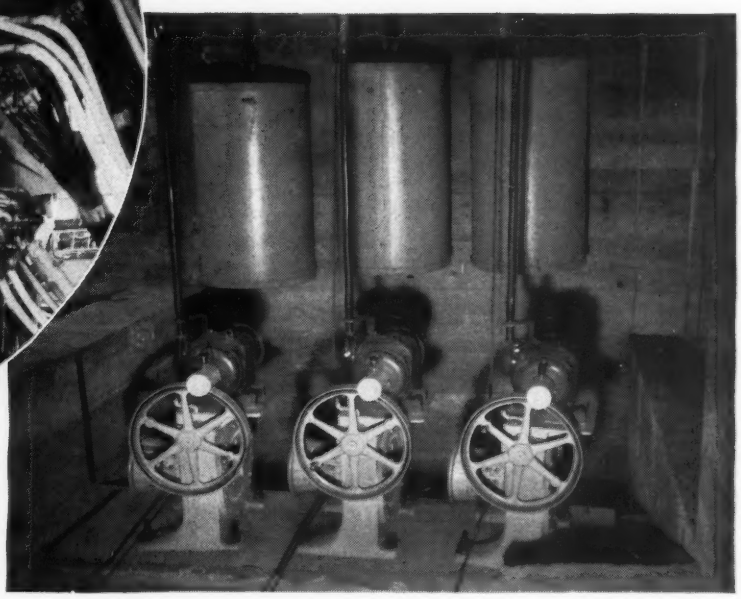
Economical Control

OF METAL MELTING

MOORE RAPID
Lectromelt
FURNACES



Lectromelt in operating position showing power operated clamps.



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CONTENTS

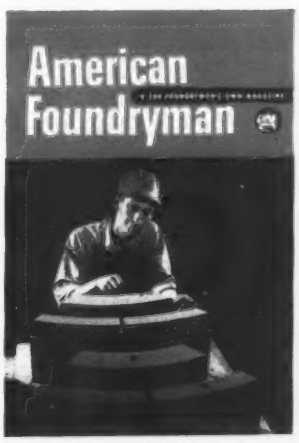
VOLUME XI, NUMBER 2

American Foundryman

February, 1947

Official publication of American Foundrymen's Association

4 February Who's Who
21 Progress in Foundry Sand Research: Dr. H. Ries
22 Nominees for A.F.A. Officers and Directors
24 Cast Iron Weld Repair Methods, Practical Application: W. J. Pfander
35 Unsoundness in Cast Light Alloys
48 A.F.A. Directors Review Progress and Plans
49 Making Permanent Molds: V. J. Sedlon
56 Cleaning Room Practice: M. P. Schemel
60 Industrial Foundry Program, Technical High School: G. A. Davis
63 New A.F.A. Members
65 Foundry Personalities
66 Chapter Officers
67 Firm Facts
68 Chapter Activities
77 Chapter Meetings, February-March
81 Abstracts of Current Foundry Literature



The American Foundrymen's Association is not responsible for statements or opinions advanced by authors of papers printed in its publication.

This Month's Cover

A General Motors Institute student busily engaged in putting the finishing touches to a special bench made core while working on the jobbing floor.

Photo courtesy General Motors Corp., Detroit

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★ FEBRUARY WHO'S WHO ★

George A. Davis

See: *Industrial Foundry Program, Technical High School* . . . Born in Baltimore, Md. . . . Attended Lewis Institute, Chicago (1925-26); University of Illinois, Urbana (1930-32); and Loyola University, Chicago (1933-34) . . . As a foundry apprentice in 1904, the author was indoctrinated into the castings industry . . . Fulfilled two years of his term with the Baltimore & Ohio Railroad, Baltimore, Md., (1904-06) and completed his training at Newport News Shipbuilding Co., Newport News, Va., (1906-08) . . . Served as molder, Nordyke-Marmon Co., Indianapolis, Ind., 1909 . . . The following year was named foundry instructor, Lewis Institute, Chicago, and remained there until 1912 . . . At Lane Technical High School, Chicago, he was appointed foundry instructor (1913-18) . . . Named foundry foreman, the author became associated with Stockham Pipe Fittings Co., Birmingham . . . In 1920 assumed a similar position with Illinois Malleable Iron Co., Chicago . . . In 1922 was made foundry instructor, Crane Technical High School, Chicago, the position he maintains at the present time . . . Has written technical articles for the trade press and meetings of various technical societies . . . A member of A.F.A.

W. J. Pfander

Cast Iron Weld Repair Methods, Practical Application, a paper written by W. J. Pfander, Ford Motor Co., Dearborn, Mich., presents to our readers a number of new ideas on cast iron weld repair . . . The author was born in Fostoria, Ohio . . . Attended classes at Arthur Hill Trade School, Saginaw, Mich., where he obtained advance courses in mathematics, metallurgy and electricity . . . From 1935-42 he was associated with Wickes Boiler Co., Saginaw, as welding and radiographic technician . . . Affiliating with Ford Motor Co. in 1942 he was named radiographic and welding engineer . . . Has written for technical societies, and in 1945 presented in Detroit before the American Welding Society a paper on radiographic inspection of welds . . . A member of American Welding Society and American Industrial Radium & X-Ray Society.

Vincent J. Sedlon

The author, Vincent J. Sedlon, whose article *Making Permanent Molds* appears in this issue, was born in Philadelphia . . . Mr. Sedlon has been associated with the pattern industry for the past thirty years . . . At present is president, Master Pattern Co., Cleveland, the position he has held since 1930 . . . The author is Chairman, A.F.A. Patternmaking Division and has been a member of various patternmaking committees . . .Has written a number of technical papers and has spoken before many A.F.A. chapters . . . Last year contributed an article to AMERICAN FOUNDRYMAN on *Pattern Analysis for Buyers of Patterns and Castings* (March, 1946) . . . Has presented papers before A.F.A. conventions concerning patterns . . . A member of A.F.A.

DETROIT IN '47

Milton P. Schemel

Contributor, Milton P. Schemel, hails from the state of New York, city of Buffalo . . . Served his electrical apprenticeship with New York Central Railroad, Depew, N. Y. (1915-19) . . . A member of the Marine Corps, he was stationed in China from 1919-23 and was discharged as sergeant . . . Began his association with Symington-Gould Corp., Depew, in 1924 as crane repairman . . . In 1928 was named sand blast foreman and the following year was appointed coupler department foreman . . . Was chipper foreman, 1932-35 . . . The next year was made assistant general finishing foreman and in 1941 assumed his present position of general finishing foreman . . . Has written for technical society meetings in relation to finishing room practice . . . Herein, see: *Cleaning Room Practice* . . . Member of A.F.A.

Unsoundness in Cast Light Alloys is a committee report . . . Prepared by the A.F.A. Aluminum and Magnesium Division, Subcommittee on Shrinkage and Porosity . . . Part I of this report was published in the January issue; Part II, the concluding installment is found herein . . . The committee includes the following: J. C. DeHaven, Battelle Memorial Institute, Columbus, Ohio, *Chairman;* Walter Bonsack, National Smelting Co., Cleveland; L. W. Eastwood, Battelle Memorial Institute; R. F. Hauser, Eclipse-Pioneer Division of Bendix Aviation Corp., Teterboro, N. J.; C. E. Nelson, The Dow Chemical Co., Midland, Mich.; and W. E. Sicha, Aluminum Co. of America, Cleveland; members of the Subcommittee on Shrinkage and Porosity, Aluminum and Magnesium Division, American Foundrymen's Association . . . The illustrations for the report were supplied by the Aluminum Co. of America, The National Smelting Co., The Dow Chemical Co., and Battelle Memorial Institute . . . The text of the report was prepared by L. W. Eastwood, and reviewed by the Committee.

PROGRESS IN FOUNDRY SAND RESEARCH

RECOGNIZING the need for study of foundry sand properties—and of methods of testing them—A.F.A., in 1921, organized a Joint Committee on Molding Sand. It soon became evident, however, that it was necessary not only to devise tests, but also to standardize them so that operators could get reproducible results. Subsequently, other committees were appointed to study particular properties. The result was organization of the Foundry Sand Research Project, now the Sand Division.

Early sand committees confined their activities to tests—and the perfection of tests—of foundry sands at room temperature. First testing was for fineness, green strength and permeability. The fineness test has become standard, but it is now considered necessary, or desirable, to apply a hydrometer test to subdivide grain sizes in the A.F.A. clay. The Committee on Grading and Fineness originally recommended plotting results as a size frequency curve, but recently approved the cumulative curve as a tentative standard.

For green strength determination, the compressive strength test has been adopted in preference to the Doty bar; and there is a tendency to give greater consideration to the green tensile strength test.

As committee work progressed it was found important to study other green properties, including deformation and sand toughness, which indicate workability; and flowability, involving the behavior of sands during molding operations. In the case of green deformation, committees have recommended changes which make the tests more accurate.

In view of the increasing use and importance of synthetic sands, greater attention also has been given bond clays and their effects on the mixture.

There are other sand properties which demand attention, such as grain shape and character of surface. The problems involved in core testing have been so great that the work has been apportioned among several subcommittees.

Green properties do not tell us how sands behave when heated. Committees are working on steel, iron and non-ferrous sands at elevated temperatures, to determine hot compressive strength, expansion and contraction, collapsibility of core mixtures, and durability. Standard tests have not yet been recommended. Study of the fundamental properties of test specimens at elevated temperatures continues.

One important result of A.F.A. sand committee work has been the development of sand control in the foundry. An increasing number of foundries have sand laboratories, and test their mixtures daily to check any change in properties against behavior in the mold and effect on castings.

Sand producers have also cooperated by grading sands according to test results. This cooperation is supplying a more uniform product. The end result has been that sands are more carefully selected with a view to better castings. It has been a satisfaction, too, to note that the testing methods developed by A.F.A. have been adopted in a number of foreign countries.

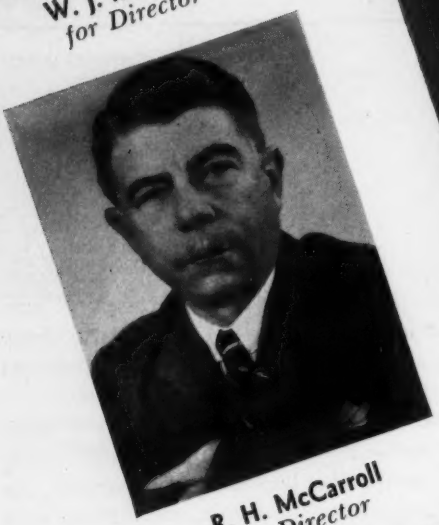
H. Ries

H. RIES, *Chairman*
A.F.A. SAND DIVISION

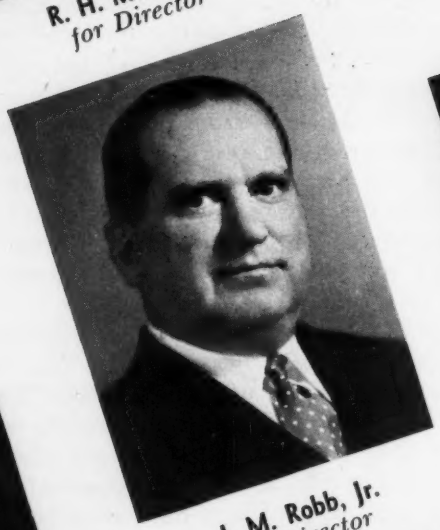
DR. H. RIES, Chairman, A.F.A. Sand Division, is well known to foundrymen in this country, as well as abroad, for his many contributions to research work on molding sands. He has been active for a number of years on various A.F.A. sand committees and has given generously of his knowledge through numerous reports, papers and books. Dr. Ries, formerly head of the department of geology, Cornell University, Ithaca, N. Y., and now retired, is a past National A.F.A. Director.

NOMINEES FOR A. F. A. OFFICERS AND DIRECTORS

W. J. MacNeill
for Director



R. H. McCarroll
for Director

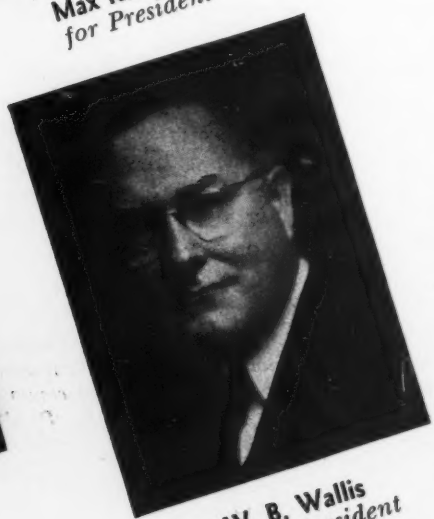


J. M. Robb, Jr.
for Director

Max Kuniansky
for President

E. N. Delahunt
for Director

A. C. Ziebell
for Director



W. B. Wallis
for Vice-President

MAX KUNIANSKY, vice-president and general manager, Lynchburg Foundry Co., Lynchburg, Va., was nominated for the office of President of the Association for 1947-48 by the Nominating Committee at its meeting in Chicago January 21. Mr. Kuniansky, who completed a three-year term as a National Director in 1946, is now serving as Vice-President of American Foundrymen's Association.

W. B. WALLIS, president, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa., was the Committee's selection for the office of Vice-President. He served on the Board of Directors with Mr. Kuniansky in 1943-46.

As candidates for three-year terms as National Directors the Nominating Committee named:

E. N. DELAHUNT, general superintendent, Warden King, Ltd., Montreal, Que., Canada.

W. J. MACNEILL, general manager, G. H. R. Foundry Div., Dayton Malleable Iron Co., Dayton.

R. H. MCCARROLL, director of chemical and metallurgical engineering and research, Ford Motor Co., Dearborn, Mich.

J. M. ROBB, JR. resident manager, Hickman, Williams & Co., Inc., Philadelphia.

A. C. ZIEBELL, president and treasurer, Universal Foundry Co., Oshkosh, Wis.

The President and Vice-President of the Association are elected by the membership for one-year terms and are installed at the time of the Annual Meeting of the Board of Directors, held, in accordance with by-law provisions, during the month of July.

Mr. Kuniansky was nominated to succeed S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, who will serve as a National Director for one year following his retirement as President. Directors whose terms expire in July 1947 are: F. J. Dost, Sterling Foundry Co., Wellington, Ohio; S. D. Russell, Phoenix Iron Works, Oakland, Calif.; R. T. Rycroft, Kencroft Malleable Co., Inc., Buffalo, N. Y.; Joseph Sully, Sully Foundry Div., Neptune Meters, Ltd., Toronto, Ont.; F. J. Walls, International Nickel Co., Detroit, now serving a one-year term as immediate A.F.A. Past President; and L. C. Wilson, Reading, Pa.

By-laws of the Association require that the Secretary shall publish the Nominating Committee report to the membership at least 60 days prior to the date of the Annual Business Meeting, scheduled to be held this year in Detroit beginning at two o'clock, the afternoon of April 30. After publication of the Committee's candidates, and at any time 45 days prior to the Business Meeting date, additional nominations may be made by written petition filed with the Secretary of the Association and signed by thirty-five members.

Should there be no nominations other than those submitted by the Nominating Committee, the Secretary "shall, at the Annual Business Meeting, cast the unanimous ballot of all members for the election of the candidates named in the report of the Nominating Committee." In the event additional candidates are nominated, the by-laws require that the election shall be by letter ballot.

F. J. Walls, designated chairman, submitted the report of the 1947 Nominating Committee. Other members of that group, six of whom were selected from a list of eligibles submitted by various A.F.A. chapters, in accordance with the by-laws, were M. E. Brooks, Dow Chemical Co., Bay City, Mich.; R. S. Davis, National Malleable & Steel Castings Co., Indianapolis; N. J. Dunbeck, Eastern Clay Products, Inc., Jackson, Ohio; R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston; Harry Ladwig, Allis-Chalmers Mfg. Co., Milwaukee; J. J. McFadyen, Galt Malleable Iron Co., Ltd., Galt, Ont.; R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., president of A.F.A. in 1944-45, and E. C. Troy, Dodge Steel Co., Philadelphia.

Chapters represented in the selections of the Nominating Committee include the Chesapeake, Cincinnati District, Detroit, Eastern Canada and Newfoundland, Philadelphia and Wisconsin. Members of the Board of Directors who will continue to serve in 1947-48 are affiliated with the following A.F.A. chapters: Chesapeake, Central Illinois, Chicago, Metropolitan. Saginaw Valley Southern California, Texas, and the Twin City.

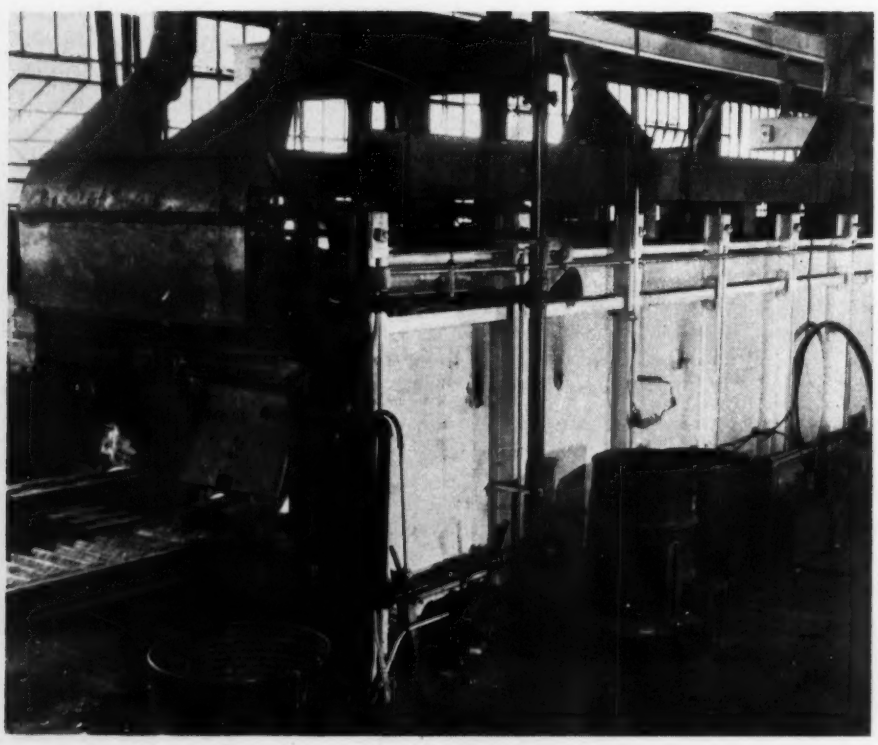
Members of the Nominating Committee at their Chicago meeting.

Fig. 1—Overhead conveyor delivering rejected cylinder blocks to welding department for repair.

Cast iron repair welding has become an important part of foundry production operations and should be treated accordingly, every effort being made to develop its applications. Modern welding procedures, equipment, and materials have solved many problems of gray cast iron repair. The fabrication of cast iron by welding has tremendous possibilities. Cast iron weldments may be produced at a considerable saving in pattern, molding and core costs. Future developments depend largely upon cooperation of foundries in exchanging ideas and bringing their problems to group discussion.

CAST IRON WELD REPAIR METHODS

PRACTICAL APPLICATIONS



W. J. Pfander
Ford Motor Co.
Dearborn, Mich.

SOME YEARS AGO the welding of cast iron was considered impractical to the extent that its use as a repair tool was not openly admitted in the better foundry circles. Early results left much to be desired in quality and performance, and the causes of the difficulties encountered were not too generally understood.

Progress in the welding of cast iron was thus retarded and not a great deal of scientific development was achieved until relatively recent years. Today cast iron is being

Fig. 2—View of gas-fired pusher-type furnace showing preheat exit and postheat entrance.

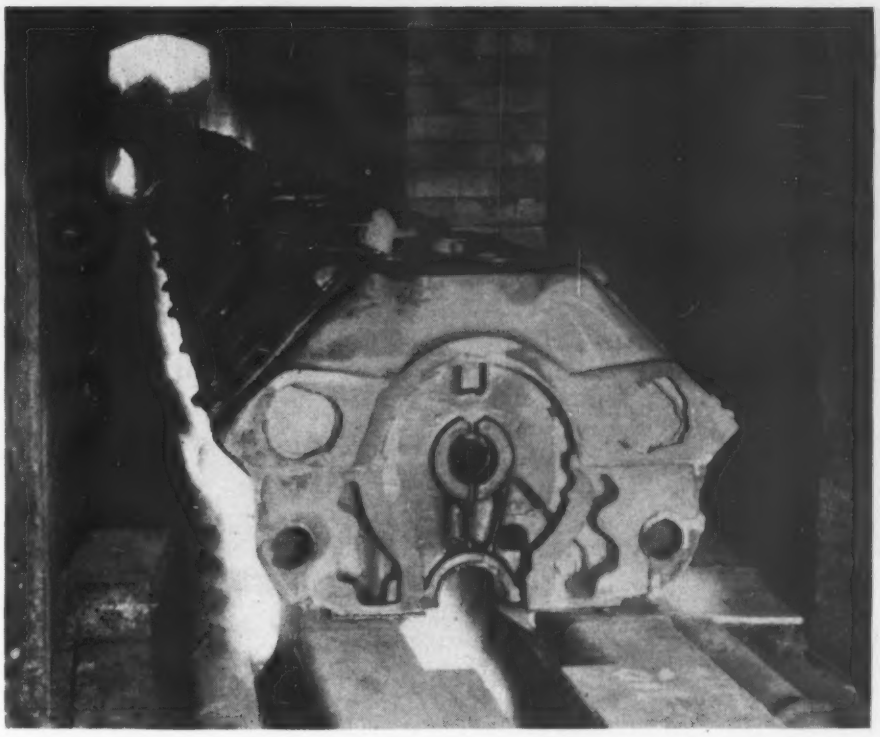


Fig. 3—Preheat passage from entrance end of furnace showing the arrangement of the burners.

welded quite generally with satisfactory results. All limitations have not been overcome but extensive progress has been made as a result of the increase in application of welding processes to cast iron.

Welding of a material possessing the chemical and physical properties of cast iron poses difficult metallurgical problems that can be solved only with the application of metallurgical knowledge and investigation. The changes in structure and differences in volume which result from heating this material above the critical temperature and subsequent cooling can be disastrous if not properly understood and controlled.

In the early days, foundries attempting this work would put a man in the darkest and dirtiest corner of the foundry or machine shop and give him the important job of reclaiming castings. Then they would wonder why the results were not satisfactory. At the company with which the author is associated this salvage work is considered an important part of production operations and, as a consequence, an attempt is made to do the job correctly and under the most favorable conditions.

In 1932, when production of "V-8" cylinder blocks was started, the losses encountered made it necessary that some means be found, in addition to acetylene welding, to salvage these castings. Up to this time little electric arc welding had been used for cast iron work because of the hardness encountered, the difficulty in getting a homogenous deposit, and non-color matching.

About this time a rod was developed consisting of about 50 per cent nickel, 30 per cent copper and 20 per cent steel, which proved to be quite satisfactory for filling small blows and defects in areas which did not require machining after welding. The deposit made by this rod could be ground flush with the casting surface and matched the color of the cast iron.

In the following years, increasing production schedules made it necessary to devise ways and means of handling larger quantities of castings and at the same time apply adequate scientific control. This was accomplished by careful consideration of all the metallurgical factors involved in the application of the different welding processes and how to best control them in production practices.

It is the purpose of this paper to demonstrate this company's present methods for making weld repairs and to disclose some of the problems encountered. Many foundrymen have had similar experiences and will find it interesting to compare their procedures with those discussed in the present paper.

Two welding processes are em-

Fig. 4—Preheat entrance of furnace showing sliding plates which lock on the rails and support block.

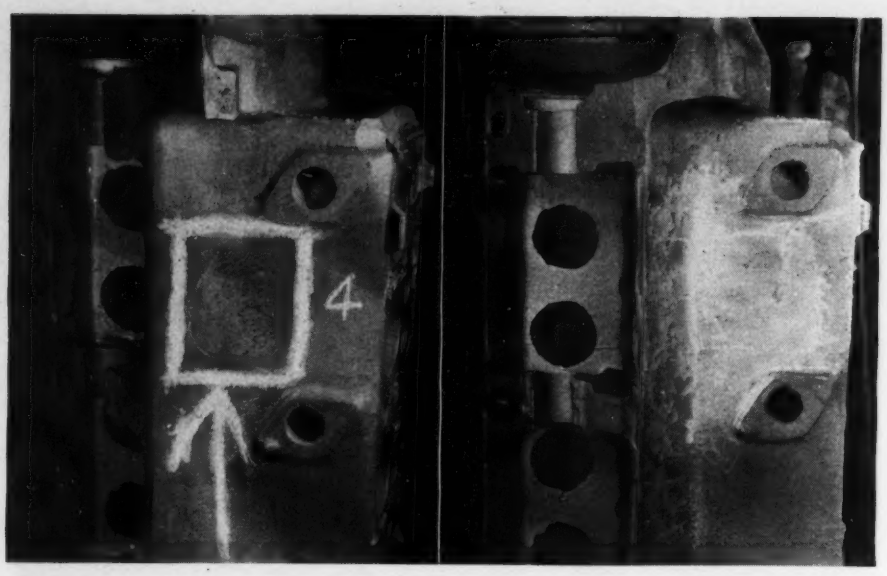


Fig. 5—Dirt defect in sidewall of cylinder block before and after repair. Furnace oxyacetylene weld.

ployed in this company's production foundry — oxyacetylene and metallic arc. Metal spray, while not a welding process, comes under the jurisdiction of the welding department and is being used in a limited amount of repair work.

The oxyacetylene welding process is the most generally used, and about 85 per cent of the welding is done by this method. It is used with two procedures, one which requires a furnace preheat and postheat and one in which local preheating is done with the torch, known as cold welding.

Acetylene Welding with Furnace Preheat and Postheat. This procedure is used on large castings where it is necessary to make repairs in areas that are restricted by the surrounding metal in their ability to contract and expand; e.g., cylinder block walls, intake port interiors, etc. Furnace preheating in repairs of this nature causes the entire casting to expand and, therefore, there is no excess concentration of stress at the area being welded.

Postheating allows the casting to cool evenly so that the highly heated areas immediately adjacent to the weld will have a chance to become almost even in temperature with the rest of the casting, thereby eliminating excessive stresses caused by uneven contraction.

Preheat temperature is held at 1100 F or just under the critical temperature, and a sufficient soaking time is allowed, depending upon the mass of the casting, to insure even distribution of temperature. Welding is started at this temperature and completed as quickly as possible; in any case, before the temperature falls below 700 F. The casting is then postheated by raising its temperature to 1050 F and slowly cooled to a maximum of 550 F before being cooled in air to room temperature.

Efficient Handling

Cylinder blocks constitute a large portion of the tonnage in this foundry and, as production may reach 6,000 blocks per day, it was found necessary to install an efficient setup for handling the percentage of these castings that must be repair welded.

Shot blasting of the cylinder blocks is done on the floor above the foundry level, and they descend on a gravity conveyor to the chipping and inspection line. Here fins and excess metal are removed by air chipping hammers and inspection made for defective blocks.

Inspectors mark for repair blocks having the following defects: surface inclusions of sand or slag, scabs, cold metal misruns, crushes, cold shuts, cracks, breaking in of gates and chipping breaks. Blocks passed by inspection move on the conveyor to the hydrostatic test stand and are tested at 60-lb water pressure, where leaky blocks are marked for repair.

Blocks which pass the water test then enter the machine shop, while all rejected blocks are placed on an overhead conveyor which carries them to the welding department (Fig. 1). Here they are again inspected, marked and separated for furnace repair, cold welding, me-

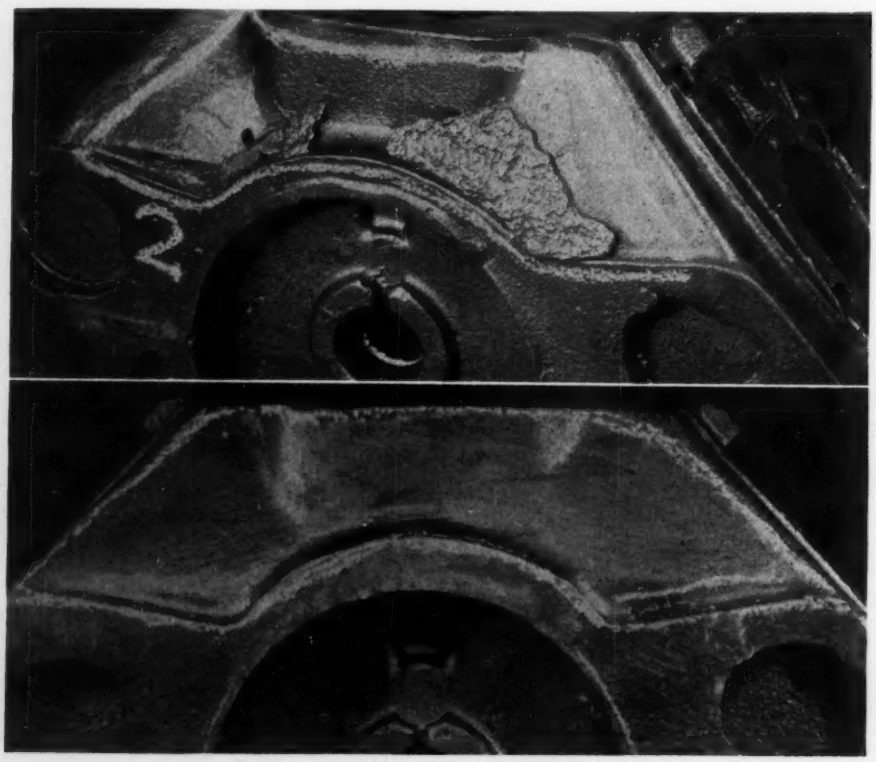


Fig. 6—Scab defect in cylinder block before and after repair. Furnace oxyacetylene weld.

tallic arc welding, or metal spray. The various repair departments are located close to the inspection area and the blocks are moved to the proper departments.

The limits as to type and size of defect it is permissible to repair are that the body or structure around the defect must be to print specification, and that no attempt be made to repair a defect which cannot be properly welded. The method of repair is governed by the location on the casting, the thickness of the metal, and other considerations consistent with good welding practice and with welding specifications which cover all the more complex castings.

Furnace repair blocks are carried down a roller-type conveyor which leads to the entrance of the preheat side of the furnace (Fig. 2). This

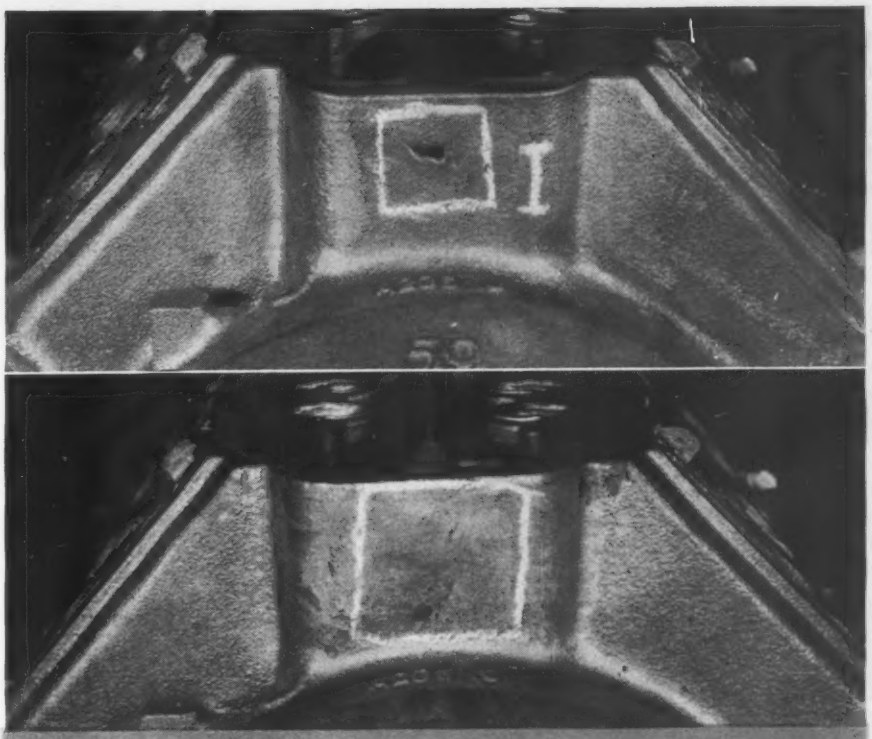


Fig. 7—Misrun in cylinder block casting before and after repair. Furnace oxyacetylene weld.

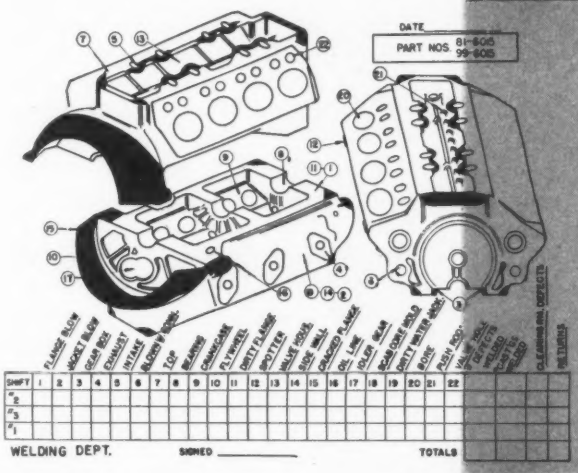
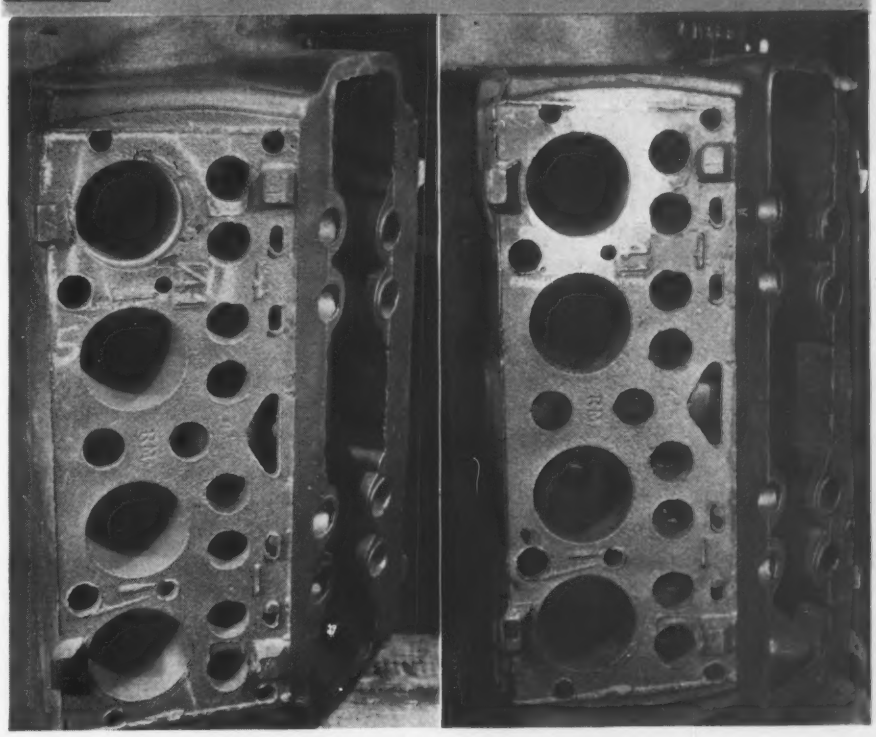


Fig. 9—Form for recording repairs. Isometric drawing of cylinder block casting. Various repair areas shown by shaded sections.

Fig. 8—Dirt defect at bore shoulder before and after repair. Furnace oxyacetylene weld.



furnace is a gas-fired pusher type using a mixture of propane and coal gas from the plant coke manufacturing operations.

It consists of two heating passages, the preheat and postheat sides which extend parallel to each other throughout the length of the furnace. Each passage is 3 ft high, 2½ ft wide and 40 ft long. Burners consist of 2 in. diameter tubing with orifice holes drilled along the top of the 18-ft lengths.

Six of these burner tubes (18-ft lengths) are mounted horizontally and lengthwise in the preheat side —three at the entrance end and three at the exit end. They are mounted just below the level of the rails on which the blocks slide, one between the rails and one on each side. In addition to these tube-type burners, there are two inspira-

tor-type burners mounted in the top of the furnace at the exit end of the preheat side.

The postheat side has two inspirator type top burners and three burner tubes (14-ft lengths) at the entrance end only (Fig. 3). The gas mixture is supplied to the burner tubes without previous mixture of air, and combustion depends upon the air present in the furnace. This is controlled by means of draft doors running the length of the furnace on both the preheat and postheat sides.

Regulation of these draft doors provides temperature control at various points in the furnace. The flame produced by the tube-type burner, while it plays directly on the block, is on the reducing side and has a tendency to spread as it leaves the burner orifice, thus producing a uniform heat distribution throughout the block.

Direct Heating Satisfactory

Experience with other types of furnaces in which the heat is supplied indirectly has proved the direct heating arrangement to be most satisfactory, especially in the postheat where the welding area is at a much higher temperature than the remainder of the casting and it is necessary to equalize the temperatures as quickly as possible to prevent cracking.

Sliding plates or shoes which lock on the rails are placed in position and the block is placed on top of them (Fig. 4). The block is then pushed into the furnace by a hydraulic ram. This automatically ejects a block at the exit end at full preheat temperature of 1050 F and ready for welding. Length of the passage will accommodate nineteen "V-8" blocks, but it is not necessary to have the furnace full to eject a block at the exit end as the shoes take the pushing load.

If a block is ready for exit and another is not available to go into the entrance end, then the required number of shoes is placed on the rails and pushed into the furnace. The ejected block is immediately picked up by electric hoist and placed on the welder's table.

Asbestos boards are placed in position around the block to prevent rapid or uneven cooling and the welding operation begun immediately. Preparation is done with the oxyacetylene torch using a neutral flame. Complete dirt and slag removal is assured as the operators have developed a great deal of skill in judging when the area is clean by observing the color of the flame.

A No. 20 welding torch and a No. 7 or 8 copper tip with the flame adjusted to neutral is used for welding. The torch is applied to a generous area around the defect to further minimize any abrupt temperature differential in the block and the defective area is brought up to welding heat.

The rod is heated, dipped in flux and applied to the desired spot. The rod is maintained at a higher temperature than the base material by concentrating the flame on it and allowing only enough heat to strike the base metal to keep it at welding temperature. This procedure helps to prevent hard spots which might be formed by allowing the cold rod to more or less quench the area.

The rod is held with its molten end in contact with the base metal, and as the rod flows into the weld it is allowed to build up and puddle until a sufficient amount has been deposited. The torch is then used to smooth the weld deposit and heat the general area before the block is returned to the furnace (Figs. 5, 6, 7 and 8).

Rod Specifications

Welds are made as quickly as possible to minimize the burning out of carbon and silicon and to return the block to the furnace before it cools to 700 F. The 5/16-in. diameter rod is cast in the company foundry to the specification:

Element	*Per Cent*
Carbon	3.35–3.55
Silicon	2.60–3.00
Phosphorus	0.40–0.60
Manganese	0.60
Sulphur	0.10 max.

This rod gives a relatively soft deposit ranging from 150 to 225 Vickers Brinell. The flux used is made in the company plant to the following composition:

Component	*Per Cent*
Boric acid	41½
Soda ash	41½
Ammonia sulphate	2
Powdered iron	15

Upon completion of the weld, the block is returned to the furnace and pushed through by the same procedure used on the preheat side. After exit from the furnace, it is ground and placed on a conveyor which carries it to a water test set up in the welding department, and by the time it arrives there it is almost room temperature.

After water test the block must go through all phases of inspection before being released to the foundry machine shop. This procedure is followed on all welded blocks no matter what type of repair weld has been made.

Repair Areas Recorded

Records of the location and frequency of repair areas are kept by the use of forms having an isometric drawing of the cylinder blocks with the various repair areas shaded and listed at the bottom of the sheet (Fig. 9). Compilation of these forms immediately shows the frequency of repair for the various areas and whether corrective measures are necessary in the foundry.

Cold Welding. This type of repair is applied sparingly to rough and rough-machined castings where there is no danger of affecting critical areas. It is confined to such places where expansion and contraction are not restricted; e.g., rough-machined surfaces which fail to clean up are welded by this method, while defects through water jackets are welded only with a furnace preheat.

Local preheating with the torch is applied in this type of welding and care is exercised to insure an even gradation of heat from the defect to the coolest sections of the casting. This is done by rotating the torch around the defect with decreasing radii of motion. The welding procedure after preheat is the same as is followed in furnace welding with the exception that the casting is allowed to cool in air instead of going through a furnace postheat (Figs. 10 and 11).

Minor Defect Repairs

Metallic Arc Welding. Metallic arc welding is used mainly on semi-finished blocks. Low areas, to a maximum of 1½-sq. in., which fail to clean up during machining, and small defects that do not go completely through the wall thickness, as well as cracks and broken locating lugs, are repaired by this procedure. All defects are prepared by grinding, drilling or chipping, with

the exception of minor welds made for appearance only.

Welding transformers are company built with a capacity of 60-250 amperes, 24 volts alternating current. Alternating current is preferred because of its smoother operation at low current values and its less penetrating arc.

Four types of welding electrodes are employed:

1. A nickel wire which is specified to a minimum of 99 per cent nickel and used exclusively on the inside diameter of machined cylinder bores.

2. A heavy flux-coated copper-nickel alloy rod, containing about 70 per cent nickel and 30 per cent copper, which is used as a filler on low areas and locations which must subsequently be machined.

3. A nickel-core electrode composed of a central core of commercially pure nickel (99 per cent) wrapped in a commercially pure copper sheath which is, in turn, wrapped in a low carbon steel sheath, and the whole flux coated. This electrode is used for miscellaneous welding where subsequent machining is not done.

4. A copper electrode composed of a commercially pure copper core wrapped in a low carbon steel sheath and flux coated. This electrode is used for repair of water jacket leaks in conjunction with the metal spray.

Nickel Electrode. Cylinder bores in which small defects are uncovered by the machining operations are repaired in a special welding booth set up in the foundry machine shop. Arc welding in the bore is limited to the following conditions:

a. Top inch of bore—no defect greater than ⅛-in. diameter can be welded.

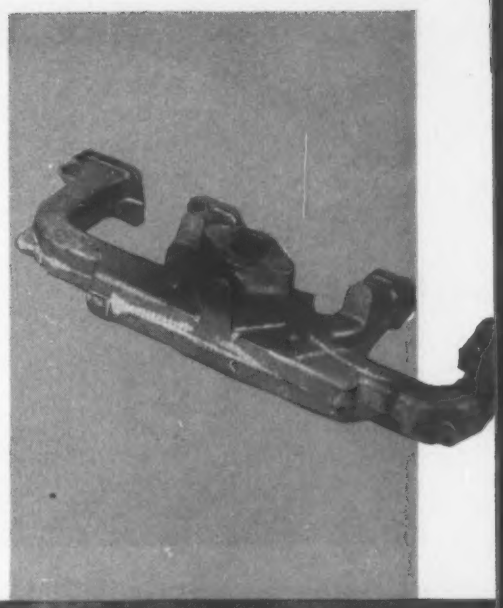
b. Remainder of bore—no defect greater than ¼-in. diameter can be welded.

c. No defect extending through more than one-half the machined thickness of the bore wall is welded.

These requirements are well within the limits of the Engineering Bulletin No. 152, Revision 1, dated Sept. 12, 1944, issued by Office, Chief of Ordnance, Detroit. This bulletin was compiled through the joint efforts of the SAE War Engineering Board and the Ordnance Department.

Defects to be welded are drilled out to investigate the extent of the defect and prepare for the welding. The drilling is accomplished with a right angle hand drill adapted for this operation (Fig. 12).

The area is preheated with a gas torch to about 150 F and the welding done with the nickel electrode of ⅛-in. diameter at about 80 amperes, 24 volts. The completed weld is carefully ground with a hand grinder until it is about flush with the surface, then finished flush with a hand lapping tool and finally polished on a production lapping machine.



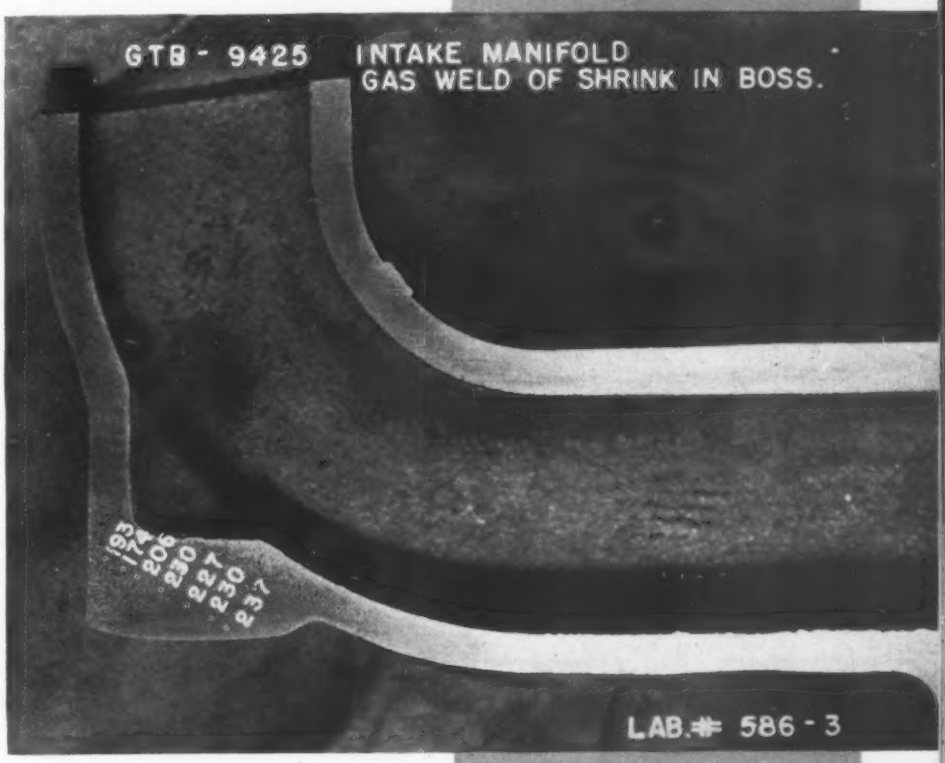
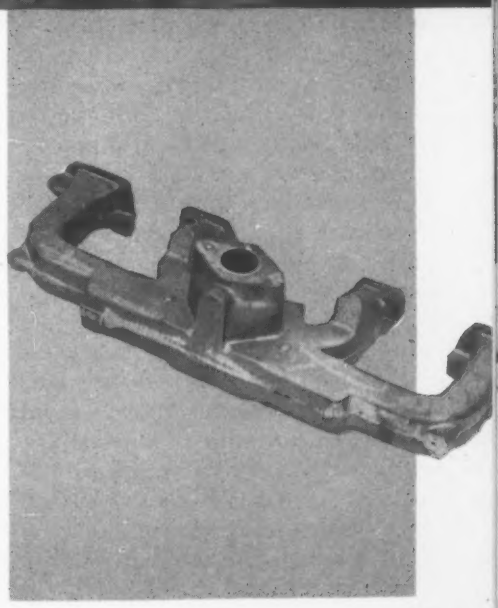


Fig. 10—(top and bottom) Repair of shrink on boss of intake manifold. Oxyacetylene cold weld.

Fig. 11—Macrosection of boss repair weld shown in Fig. 10.

Copper Nickel Electrode. Cylinder blocks which require building up in areas which must be machined, e.g., broken bosses, are ground when necessary and preheated with a torch to about 600 F. The preheating is carefully done to insure an even distribution of heat and the weld made with a 5/32-in. diameter Cu-Ni electrode.

This procedure gives a weld hav-



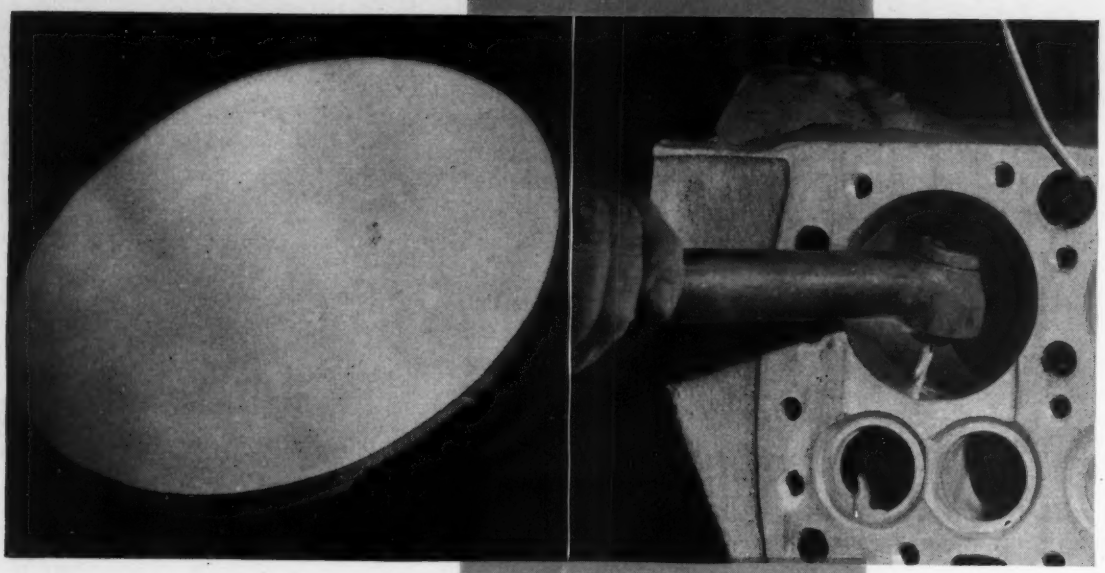


Fig. 12—Drilling out bore defect in cylinder block casting with specially adapted angle hand drill.

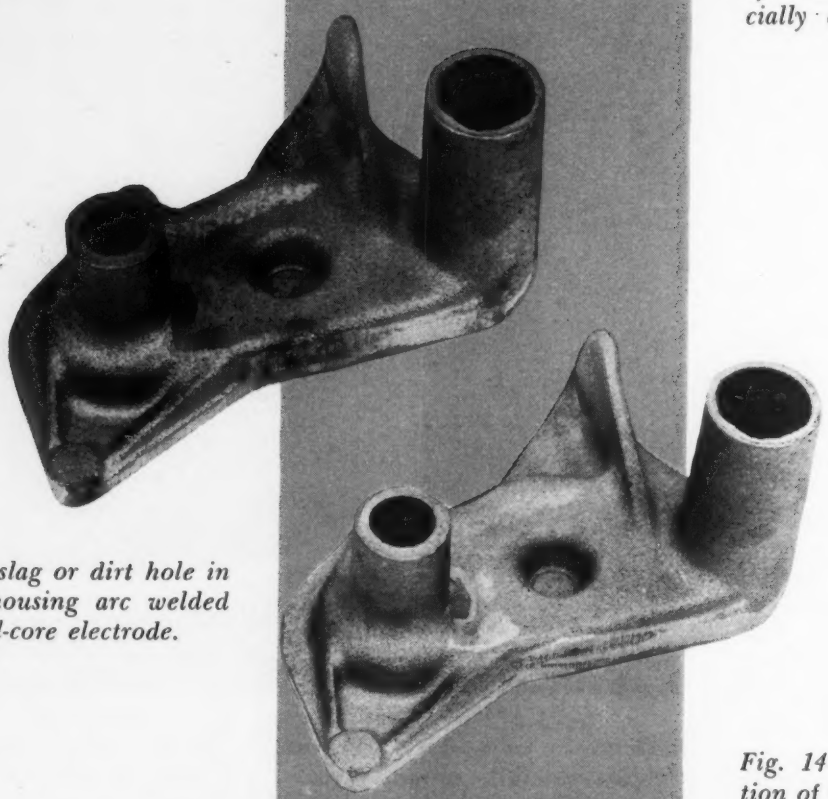
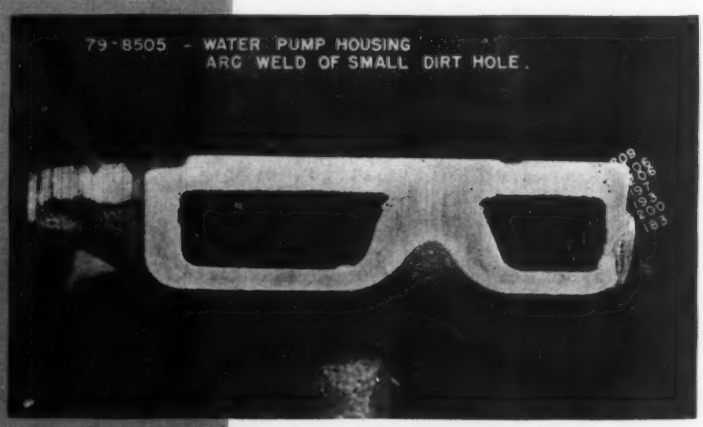


Fig. 13—Small slag or dirt hole in water pump housing arc welded with nickel-core electrode.

Fig. 14—Photograph of macrosection of water pump housing repair weld shown in Fig. 13.



ing no hard fusion zone and easily drilled and tapped. The deposit from this electrode will be soft and machineable when made without preheating, but the fusion line might be somewhat hard. In making large repairs and where machineability is quite critical it is better to preheat to at least 500 or 600 F to counteract expansion and contraction stresses and soften the fusion line (Figs. 13 and 14).

Preheating Small Defects

Small defects uncovered during machining are preheated to about 200 F and welded with the copper-nickel electrode. When necessary, they are drilled with a 1/4-in. drill to remove dirt, and the deposit in all cases is ground or filed flush before machining.

Due to rough handling, flywheel housings which are cast to the "V-8" block will occasionally be cracked. In this case the crack runs to a free edge which must be machined. The closed end is drilled beyond the end of the crack with a 1/4-in. drill and the crack ground to form a "V" trench for welding. The area is preheated to about 500 F and the nickel-core electrode used to fill the "V" up to the free edge. The free edge is welded with the copper-nickel electrode to secure a machineable deposit (Fig. 15).

Nickel-Core Electrode. The nickel-core electrode is used on surfaces which do not require machining, and is used without preheat where the defects are small and on relatively heavy sections. If the defect is large and the mass of weld deposit required might cause considerable thermal stress, then the area is preheated.

If drilling is required to remove dirt, a slight preheat generally is used. All deposits made with this electrode are ground or filed flush with the surface.

Metal Spray Procedure

Copper-Core Electrode. The copper-core electrode is used in the metal spray procedure along with the nickel-core electrode. This procedure is confined to those areas which are not machined and can be satisfactorily shot blasted, such as water jacket walls.

Seepers or leaks which would require mechanical plugging are repaired by this method. Its advantage lies in the fact that it covers a much greater area than that covered by plugging. A leaking type of defect usually is associated with spongy metal, and plugging does not assure that new leaks will not develop in the adjacent area.

Seeping locations are either ground or drilled with a 7/32-in. diameter drill until a clean cavity is assured (Fig. 16). A gas torch is employed for preheating to about 150 F and an 1/8-in. diameter copper-core electrode is used to make a deposit in the bottom of the preparation. This electrode gives a dense, defect-free, water-tight deposit, effectively sealing openings.

An 1/8-in. diameter nickel-core electrode is then deposited to fill the preparation and give a color-matching repair. The deposit is then ground flush with the surface and the whole area is shotblasted (Fig. 17). The sprayed metal requires a rough surface for adherence as it bonds mechanically to the base metal.

Size G-16 grit is used in the blasting operation and provides a satisfactory surface with sharp, angular indentations into the base metal. A generous area around the defect is blasted to insure good coverage.

Spraying Two Metals

It is necessary to spray two metals on the area. The first is of commercially pure 0.090-in. diameter copper wire sprayed to a thickness of approximately 0.010-in. This is followed by a coat of 0.090-in. diameter low carbon steel wire sprayed on the copper to about 0.005-in. thickness. The copper provides a good bond to the base metal and the steel gives an acceptable color match to the casting (Figs. 18 and 19).

Water pressure testing, after repair is completed, seldom results in rejection of the casting.

All of the aforementioned welding procedures, with the exception of the metal spray, are applicable to any of the gray iron castings produced in this foundry. Restrictions on welding are determined by the casting design and the use for which it is intended; e.g., cylinder heads due to their flat shape and stressed condition may not be welded beyond 1 1/2-in. from each end unless they are furnace preheated to temperature of 1100 F.

Preheating is done in an open furnace in which the castings are placed on racks located above an open gas flame. This type of casting is easily warped with a localized welding heat. Combustion chambers in cylinder heads are not welded as the operating conditions in this area are severe.

Severe Stress Conditions

Operating conditions of the part under consideration for weld repair should be well investigated before any welding is attempted. If these conditions are so severe that any variation in hardness or structure is liable to result in failure, then welding is prohibited.

If it is considered necesary to weld in an area of severe operating stress, then breakdown tests should be made to determine the effect on part life. Welding in this application is best done using the oxy-acetylene method with properly applied preheat and postheat.

Extent and location of the defect are also factors which determine the welding procedure to be used. Generally, small defects of 1/4-in. diameter in areas not requiring machining can be metallic arc welded without preheat. A slightly larger defect might require preheating to offset thermal stresses. A large defect in the same area might require a high preheat and postheat as well.

Areas requiring machining should be gas welded or metallic welded with the copper-nickel alloy rod. Extent of the defect and accessibility determine the method.

Economy Factor

In dealing with small castings a check on welding costs will sometimes reveal that it is more economical to scrap the pieces. Economy is a factor which must be closely watched in a large foundry. It is convenient to send castings for weld repair when a rather large department is available for this operation. Therefore, it is necessary for the control department to keep a close check on all castings sent for weld repair and consider them from the economy standpoint.

Today all foundries large and small must recognize that welding has of necessity become an important part of production operations. It should be treated as such

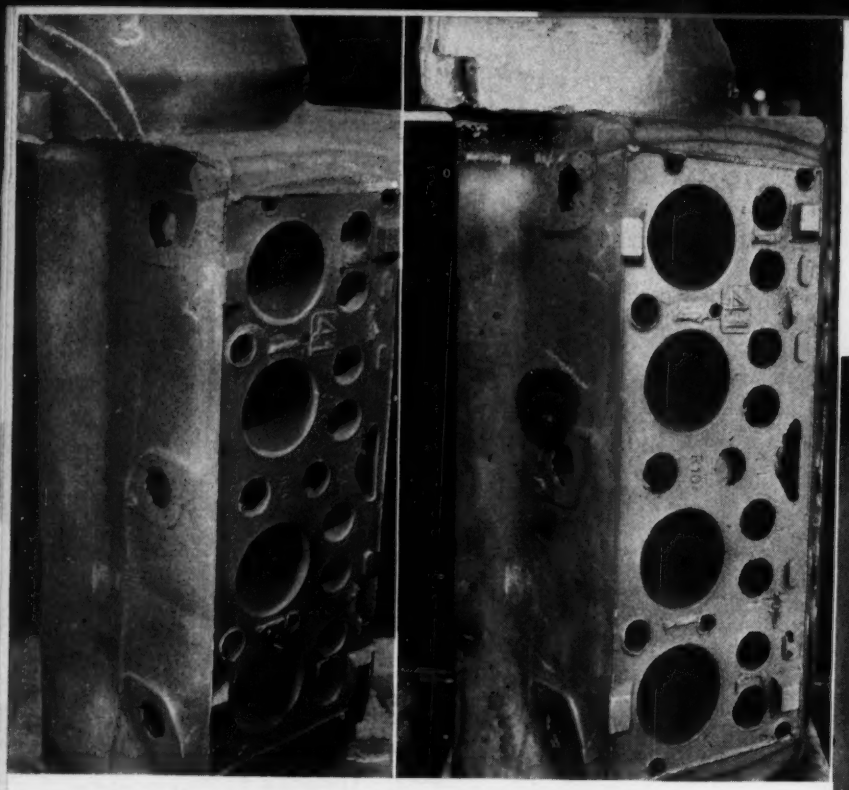


Fig. 15—(left above) Cracked flywheel housing arc welded. Nickel-core and copper-nickel electrode.

Fig. 16—(left) Grinding seepage area in cylinder block casting in preparation for metal spray.

Fig. 17—(above) Gritblasting the area shown in Figs. 15 and 16 to provide rough surface for spray.

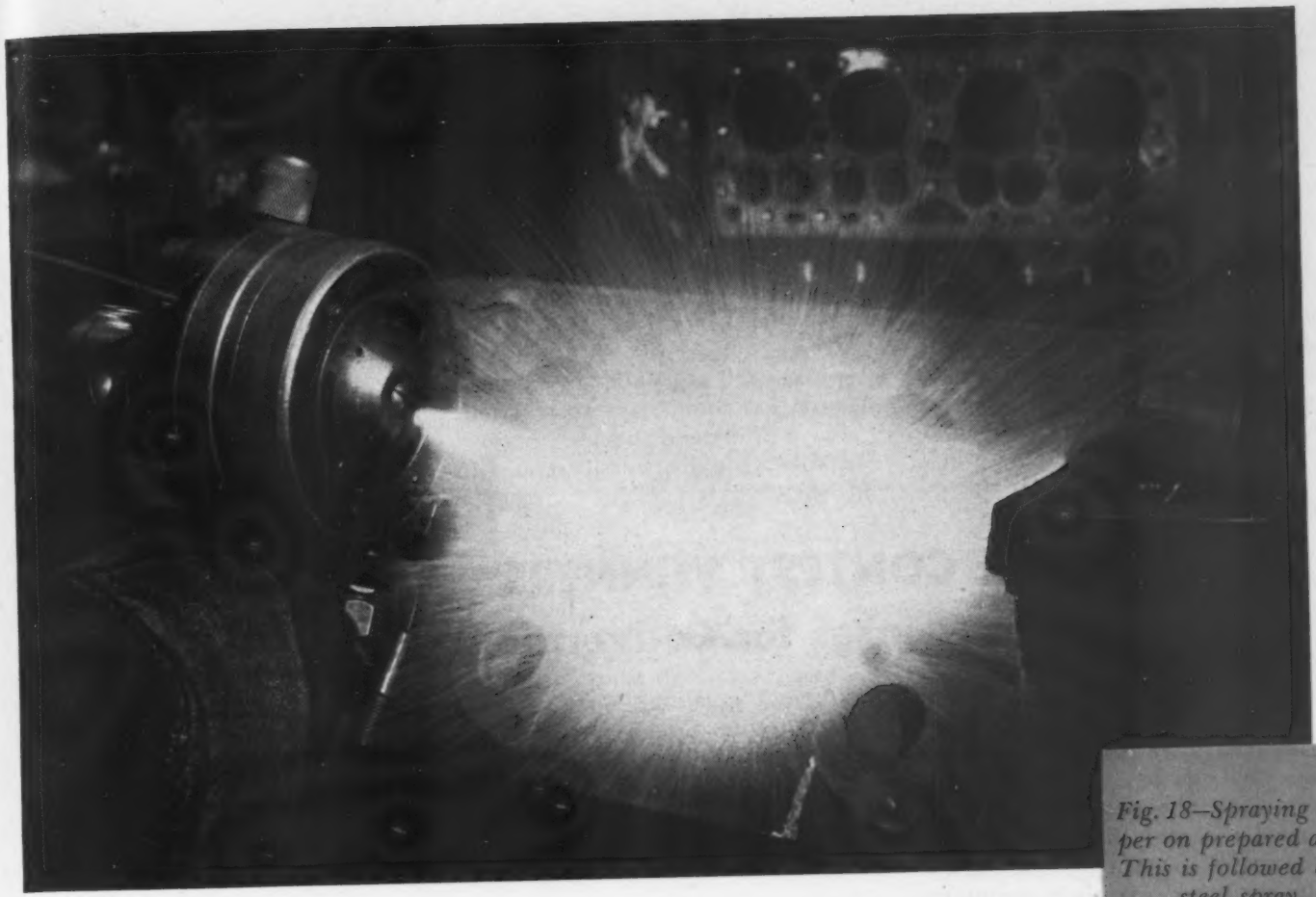


Fig. 18—Spraying copper on prepared area. This is followed by a steel spray.

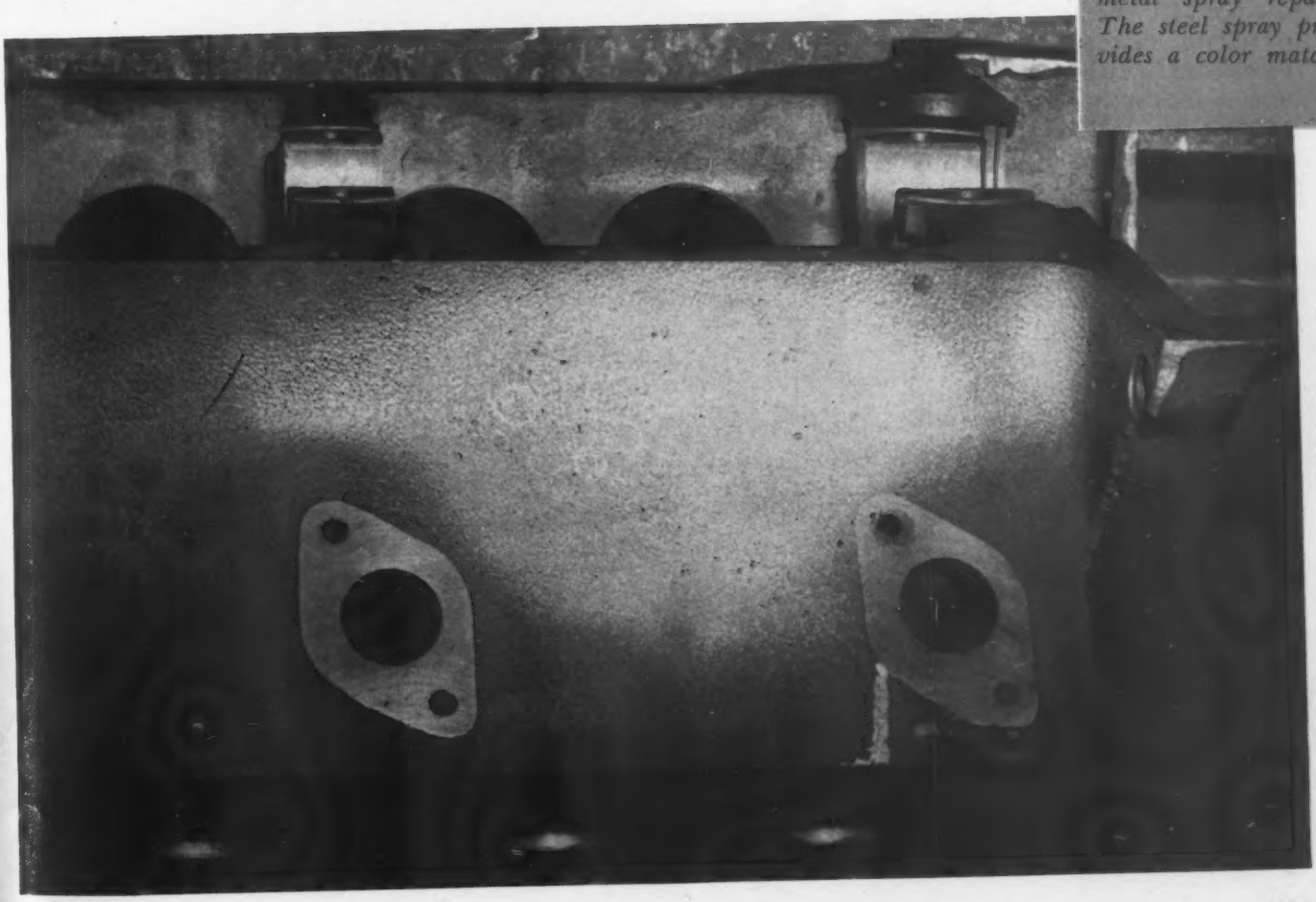


Fig. 19 — Completed metal spray repair. The steel spray provides a color match.

and every effort made to improve and develop its application.

Economy of the operation is largely determined by the investment in proper equipment, materials and personnel. If it is left to more or less shift for itself under a cheap and inefficient setup, then the results obtained will be correspondingly cheap and inefficient. Practically any gray cast iron welding problem can be solved by the use of present day welding materials and equipment and proper application of the various methods.

An indication of the progress of gray iron welding is illustrated by its use today in fabricating gray iron parts. A certain foundry making stove castings found that a particular casting was exceedingly expensive to make due to its shape and core requirements. The solution was found by casting in two separate sections and metallic arc welding them together.

A copper-nickel alloy electrode was used for the job, with one man welding 480 assemblies in an 8-hr. day. All assemblies are water tested after welding and the one per cent of leakers found are easily repaired.

APPRENTICE CONTEST WINNERS Voted Travel Expenses for Convention

SINCE INCREASING the prizes in the A.F.A. Annual Apprentice Contest to 100, 50 and 25 dollars in each of the four contest divisions, the Board of Directors has acted to enable first-prize winners to attend the Annual Convention, by voting to pay their round-trip Pullman and first-class rail fares.

Any indentured apprentice who meets entrance requirements may compete for the cash prizes and certificates awarded the three best contestants in each of the four divisions of the contest. These divisions are gray iron molding, steel molding, non-ferrous molding, and patternmaking. It is not necessary for an apprentice, nor the plant to which he is apprenticed, to be a member of A.F.A. in order to be eligible. Complete details and contest regulations may be secured by writing to the American Foundrymen's Association, 222 West Adams Street, Chicago 6.

Many Plants Interested

Year after year, apprentices from many foundries and pattern shops enter the A.F.A. Annual Apprentice Contest, and many shops have sponsored a number of contest winners. Foundry and patternmaking apprentices of Brown & Sharpe Manufacturing Co., Providence, R.I., have participated nearly every year since the contest was started in 1924. This company has long been interested in apprentice training and was represented by R. Viall on the Association's first Apprentice Training Committee.

Frequently winners in the contest, Brown and Sharpe apprentices receive additional recognition through a plaque the plant has provided. What the plaque, shown in the adjoining illustration, means is stated below by J. E. Goss, industrial activities administrator for the company and veteran member of the A.F.A. Apprentice Training Committee.

"The plaque symbolizes our pride in accomplishment with apprentices.

"It challenges us, not simply to continue as we have in the past but to improve our apprenticeship system.

"It stands as a monument to apprentices of the past and as an emblem of hope to those of the future.

"It serves as a reminder that no foundry or pattern shop is going to be content to see any one company's list of winners become very long.

"It is fitting evidence that the foundry industry has, in A.F.A., a co-ordinating agency which senses the value of competition among youth and makes effective application of it."

B·S
BROWN & SHARPE APPRENTICES WHO HAVE WON PRIZES IN THE NATIONAL CONTESTS FOR APPRENTICES SPONSORED BY THE AMERICAN FOUNDRYMEN'S ASSOCIATION
1927 Lester G. Furber Third Patternmaking
1928 Peter G. Bathgate First Moulding
1929 Norman F. Chapman First Moulding
1929 Carl W. Hansen Second Moulding
1929 Vasken Tatewosian Second Patternmaking
1929 Valmore N. Blais S. Obermayer Prize
1930 Moroni Heap First Moulding
1932 Moroni Heap First Moulding
1932 Oscar E. Frederick Second Patternmaking
1936 Russell L. Ashworth Third Moulding
1937 John Waddington Second Moulding
1938 Edward A. Menzel Second Patternmaking
1939 Louis W. Greenslade, Jr. First Moulding
1940 Thomas F. Murphy First Moulding
1941 Henry L. White First Moulding
1943 Theodore H. Anderson Second Moulding
1943 William Waddicor, Jr. Second Patternmaking

UNSOUNDNESS IN CAST LIGHT ALLOYS

PART II — the second and concluding installment of this A.F.A. committee report. The first installment appeared in the January issue.

A.F.A.
Aluminum and Magnesium
Division
Subcommittee on
Shrinkage and Porosity

Effect of Solidification Rate and Gas Content. The effects of solidification rate or section thickness and gas content of the melt on the amount, size, shape, and distribution of pinhole porosity in aluminum alloys have been described in detail elsewhere.[1] A few illustrations will be shown which will also indicate the correlation of the appearance of the machined surface and the appearance of the unsoundness on an x-ray film.

Figure 27 illustrates the test casting employed. Figures 28 to 33, inclusive, illustrate sections cut from the test casting having steps 4 in. long, 3 in. wide, and 3, 1½, and ¾-in. thick. The alloy is No. 122 containing 10 per cent copper, 1.2 per cent iron, and 0.2 per cent magnesium. All of the molds were made of dry sand to prevent gas absorption in the mold cavity.

Longitudinal vertical sections were cut from the mid-portion of the casting, and Figs. 28, 30, and 32 show machined surfaces of these sections cut from castings poured, respectively, from a melt of low gas content, medium gas content, and high gas content.

Sizes of Sections

The 3-in. section is shown at the top, the 1½-in. section in the center, and the ½-in. section machined from the ¾-in. portion is shown at the bottom in each of the photographs. Figures 29, 31, and 33 are radiographs of 3/16-in. thick sections of the same castings illustrated by Figs. 28, 30, and 32 of the machined surfaces.

Pinhole Porosity Occurrence

On the basis of these six figures which show typical effects of gas content and section thickness on the occurrence of pinhole porosity, it may be concluded that:

1. As the section thickness increases, all other factors the same, the total volume, size, and angularity of the pinholes increase.
2. Total volume of the pinholes, their size and number increase with increasing gas contents.
3. The machined surface shows only the voids on a plane; whereas the radiograph presumably shows all or most of the voids in a sec-

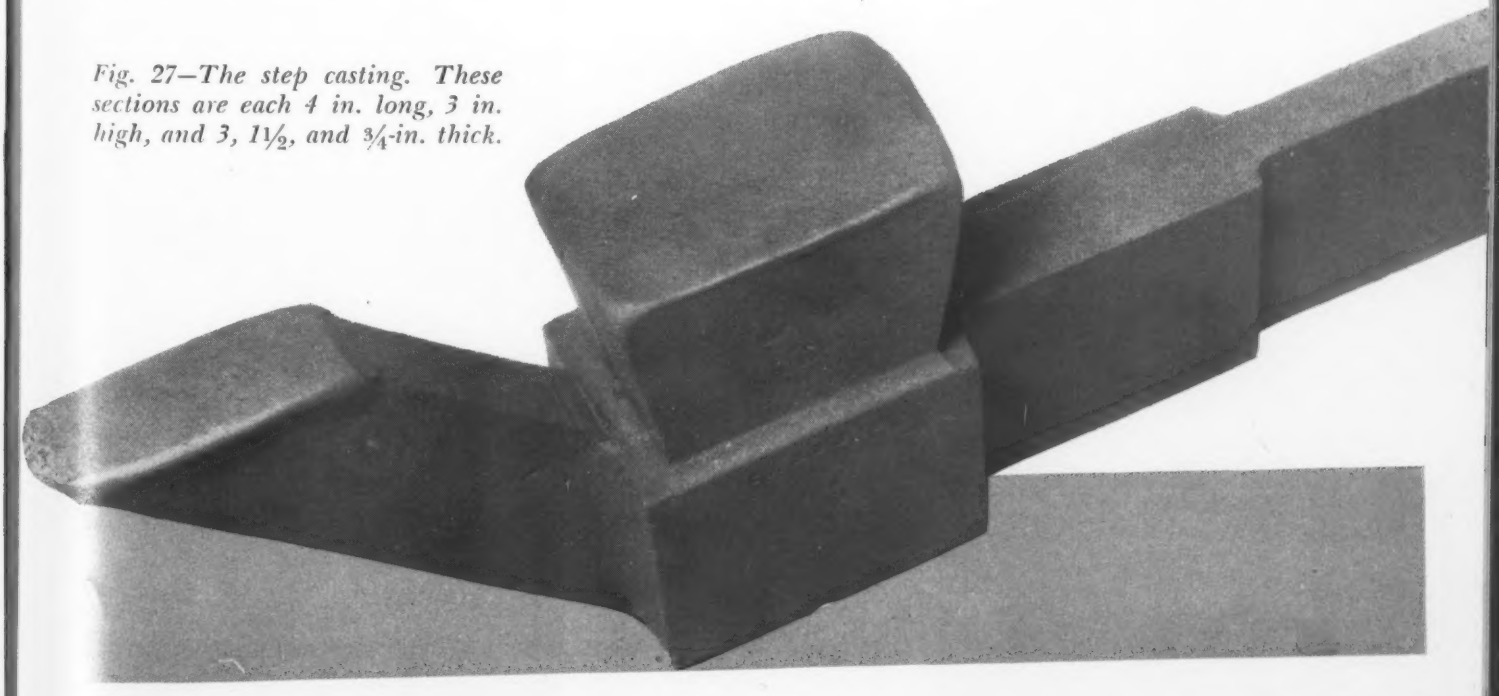


Fig. 27—The step casting. These sections are each 4 in. long, 3 in. high, and 3, 1½, and ¾-in. thick.

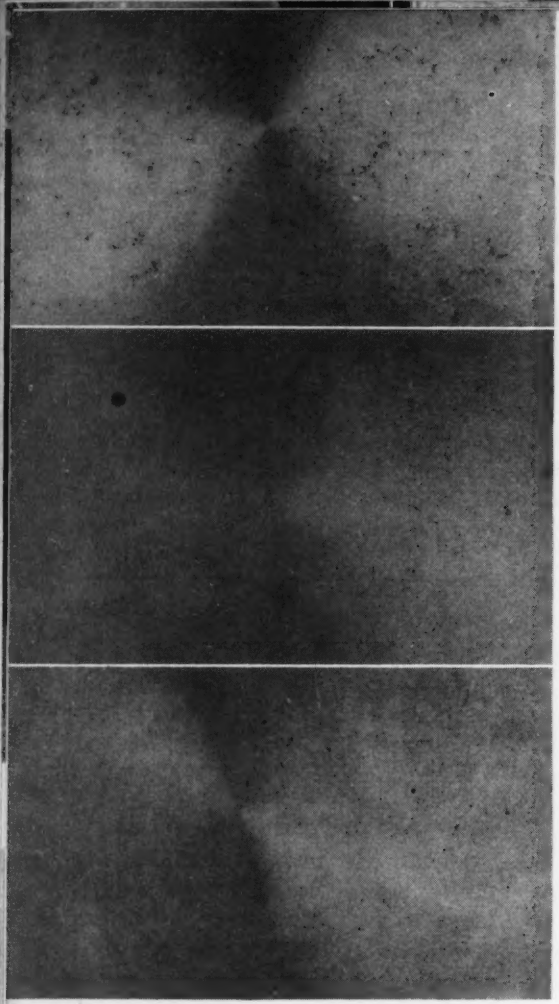


Figure 28

Photograph of machined mid-sections cut from the step casting (Fig. 27) poured in dry sand mold, using degassed No. 122 alloy containing 10 per cent Cu, 1.2 per cent Fe, and 0.2 per cent Mg; 3-in. section top, 1½-in. section center, ¾-in. section bottom. ×1.

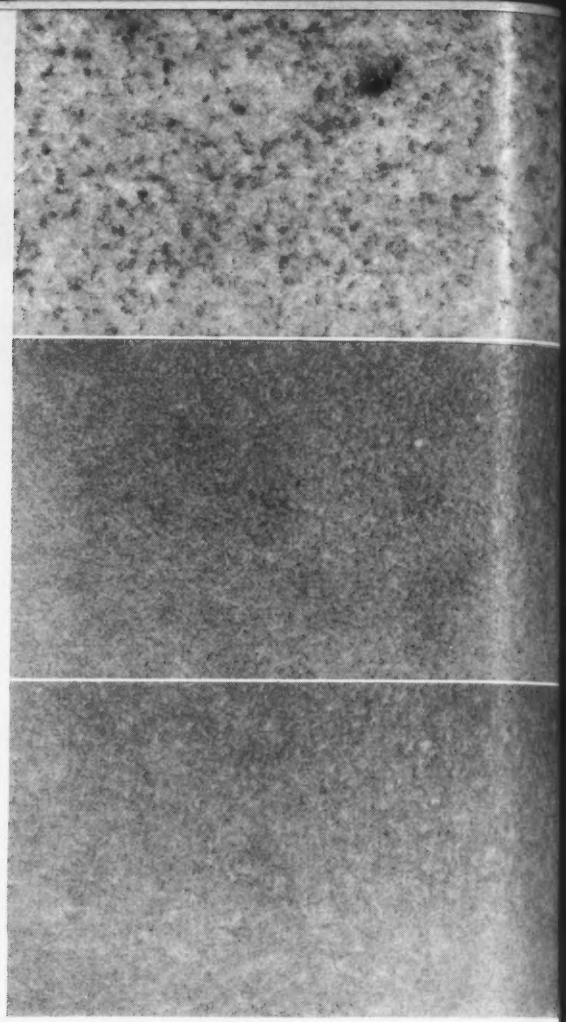


Figure 29

Radiograph of approximately $\frac{3}{16}$-in. sections cut from the same casting shown in Fig. 28. ×1.

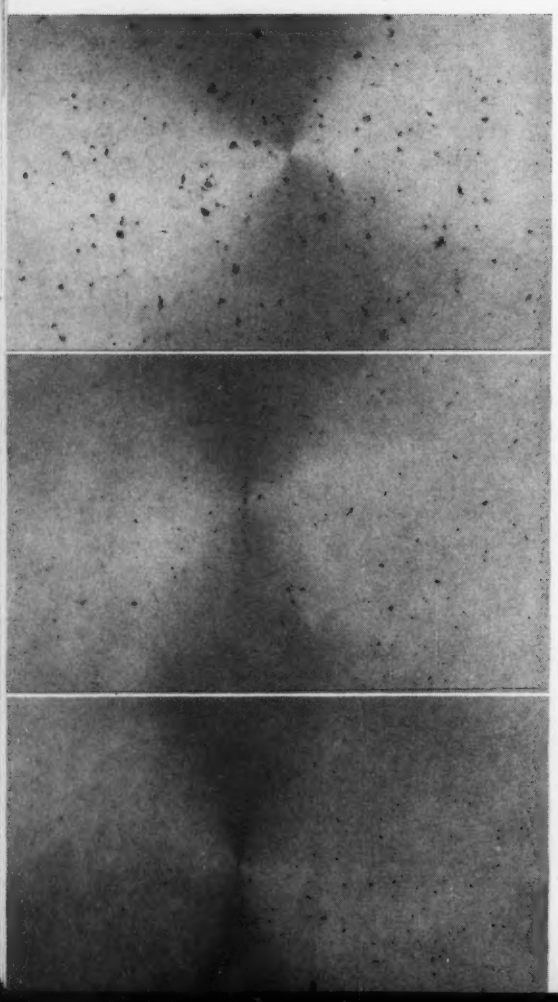


Figure 30

Similar to Fig. 28, except that the metal contains a medium amount of gas. ×1.

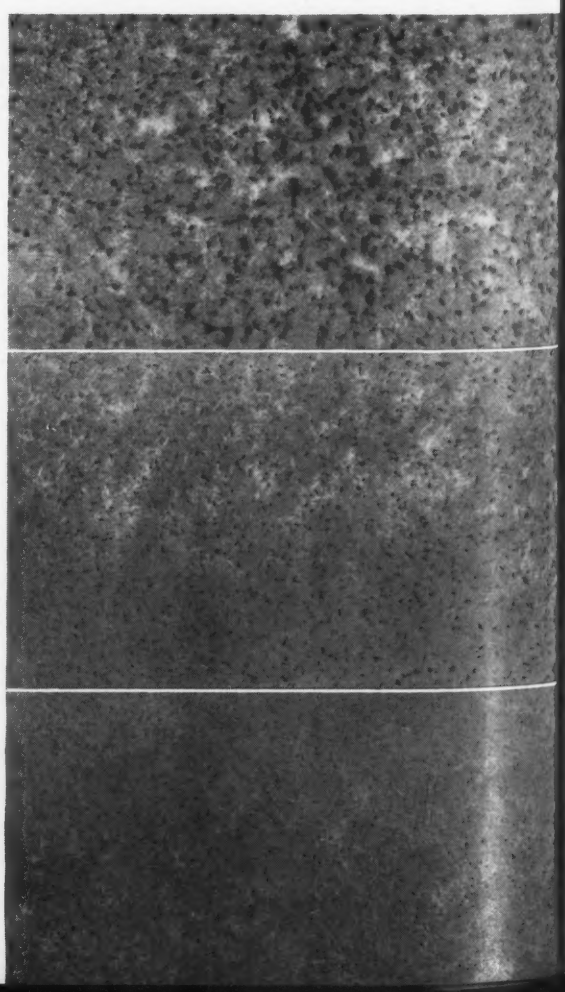


Figure 31

Radiograph of sections shown by Fig. 30. ×1.

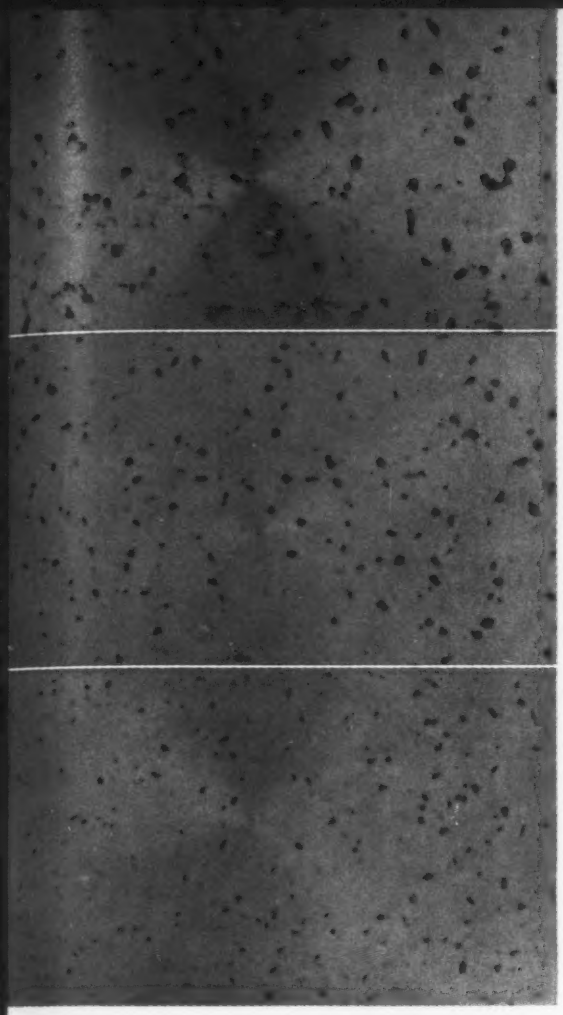


Figure 32

Same as Fig. 28, except that the castings were poured from a melt containing a large amount of gas. ×1.

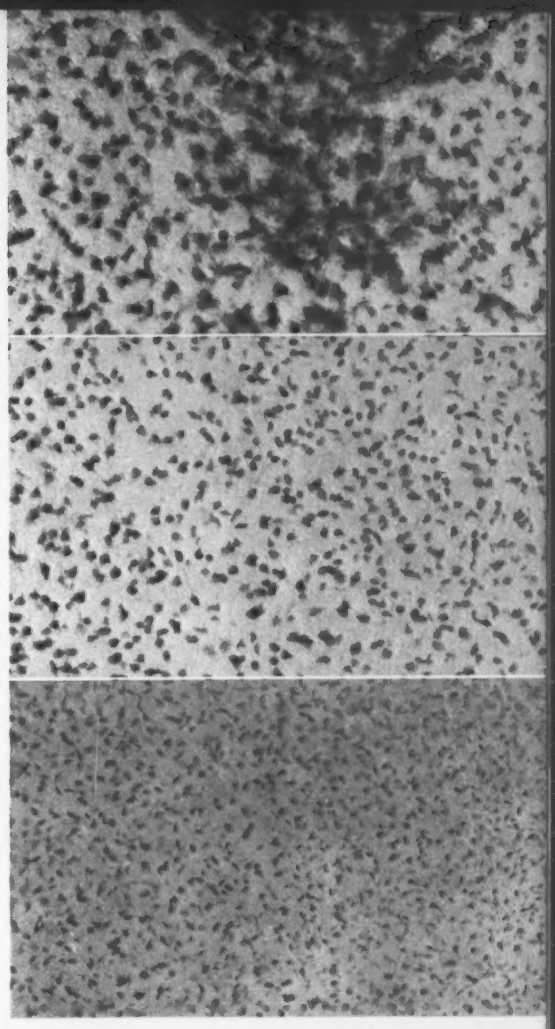


Figure 33

Radiograph of sections shown by Fig. 32. ×1.

tion of substantial thickness, in this case about 3/16-in. Accordingly, the severity of the porosity revealed on the radiograph is far greater than that revealed on the machined surface.

4. There is some tendency for localized shrinkage of a general, spongy nature to occur in the 3-in. section, which in this case was not fed particularly well. This spongy localized shrinkage is closely associated with, and not entirely distinguishable from, pinhole porosity.

These principles probably also apply to gas holes in magnesium, but for reasons indicated previously they would have little practical significance for the magnesium founder.

Effect of Grain Size. In general, all other factors being the same, the pinhole porosity in aluminum-base alloys is rounder and smaller, the finer the grain. This is illustrated by Fig. 34 which shows a photograph at the left, and a radiograph at the right of polished sections of No. 195 alloy cut from 2½-in. cubes poured in green sand. These sections have been given a grain-size etch. This alloy contains a nominal 4.5 per cent copper with iron and silicon in approximate amounts of 0.6 to 0.8 per cent each.

The melt was gassed with ammonium chloride and the castings were poured at 1450 F. The casting at the bottom shows the grain size and porosity obtained before grain refinement, and the two photographs at the top show the castings after grain refinement was obtained by adding 0.10 per cent titanium. Because the melt was gassed, the pinhole porosity is severe. It will be noted, however, that there are many more pinholes of finer, more equi-axed shape in the fine-grained casting.

Mold Material

Effect of A.F.A. Permeability and Moisture Content of the Molding Sand. Figures 35 to 38, inclusive, show an interesting effect of mold material upon the occurrence of pinhole porosity in No. 355 alloy castings. No. 355 alloy contains a nominal 1.3 per cent copper, 5 per cent silicon, and 0.5 per cent magnesium. This alloy was prepared, degassed by fluxing with chlorine, and then poured into the step castings described previously and illustrated by Fig. 27.

Figures 35 and 36 show castings which were poured in a natural green sand having an A.F.A. permeability of 35 and 5.0 per cent moisture. Of these two figures, Fig. 35 represents the appearance of the machined surface of longitudinal vertical sections cut through the center of the castings. The 3-in. section is at the top, the 1½-in. section at the center, and the ¾-in. section at the bottom. On the other hand, Fig. 36 shows the same machined section, but the machined surfaces are adjacent to the cast surface.

Figures 35 and 36 should be compared with Figs. 37 and 38 which are entirely similar, except-

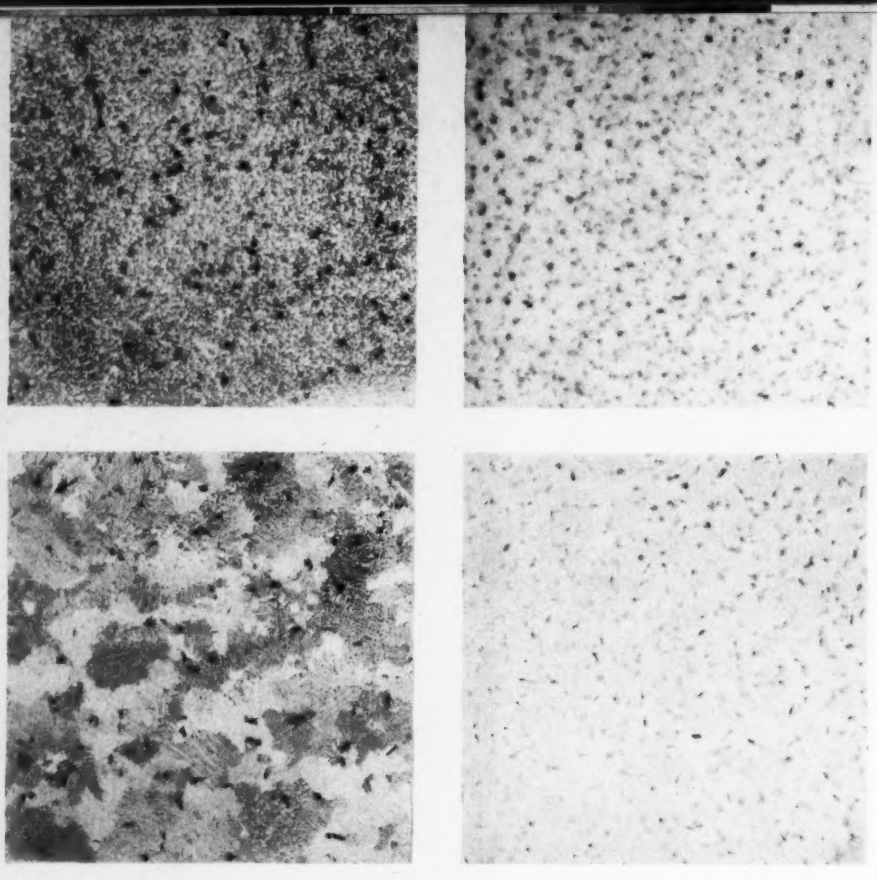


Fig. 34—Photograph at the left and radiograph at the right of polished and etched mid-sections of No. 195 alloy cut from 2½-in. cubes poured in green sand. Metal was gassed with ammonium chloride. The sections shown by the lower half of the figure were poured at 1450 F, after which grain refinement was obtained by adding 0.10 per cent Ti. The castings illustrated by the upper portion of the figure were then poured at 1450 F. This alloy contains a nominal 4.5% Cu with 0.6 to 0.8% each Fe and Si. ×1.

Figure 35

Machined mid-section cut from the step casting (Fig. 27). The melt was poured in green sand molds having an A.F.A. permeability of 35 and 5 per cent water. The metal was substantially free from gas as the result of the chlorine fluxing operation applied. Top—3-in. section. Center—1½-in. section. Bottom—¾-in. section. The alloy is No. 355 containing 1.3 per cent Cu, 5 per cent Si, and 0.5 per cent Mg. Compare with Figs. 36, 37, and 38. ×1.

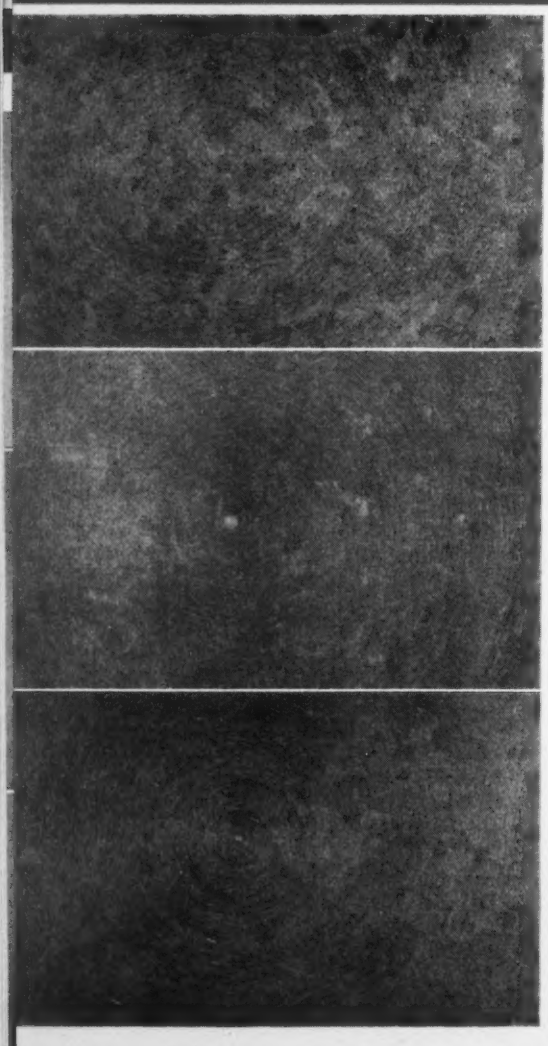
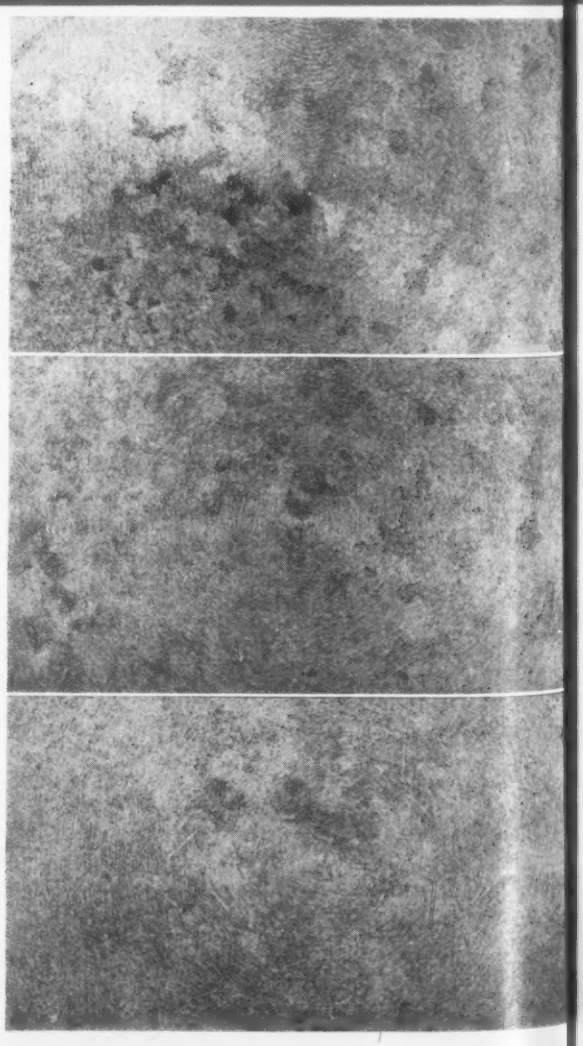


Figure 36

Same as Fig. 35, except that the sections machined were near the cast surfaces of the steps. Top—3-in. section. Center—1½-in. section. Bottom—¾-in. section. ×1.



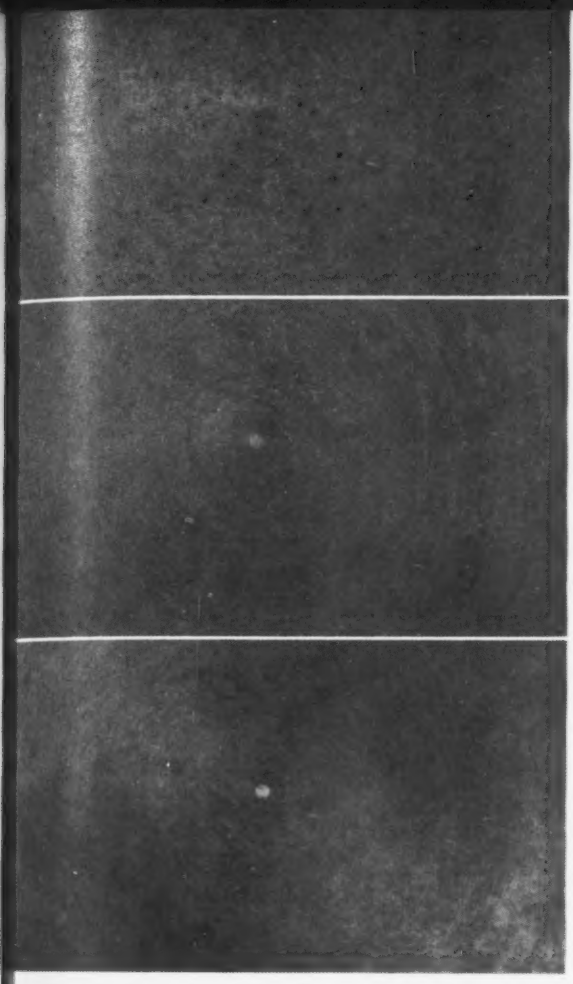


Figure 37

Same as Fig. 35, except mid-sections are from a step casting which was poured in a green sand mold having an A.F.A. permeability of 7.5 and a moisture content of 7.5 per cent. ×1.

Figure 38

Same as Fig. 37, except that the machined sections are adjacent to the cast surface. ×1.

ing that the natural green sand mold had an A.F.A. permeability of 7.5 and 7.5 per cent moisture. Of these two photographs, Fig. 37 shows machined longitudinal vertical sections cut down the center of the casting. On the other hand, Fig. 38 shows similar machined sections adjacent to the surface of the casting. The explanation of the great concentration of pinholes near the surface is unquestionably as described in the following.

Mold Gases

The melt poured into the mold having high moisture and low permeability generated enough mold gas pressure that the gas was able to penetrate into the melt in the mold before the metal solidified. These mold gases consist largely of steam, the hydrogen from which is rapidly absorbed by the melt.

When the latter solidifies, this gas is reprecipitated in the form of pinholes but due to the fact that relatively limited time is involved, the gas has only slightly penetrated to the center section of the casting. The amount of pinhole porosity increases rapidly as the surface of the casting is approached. It would be erroneous to assume that these pinholes are trapped mold gases. On the contrary, they are formed by hydrogen which was dissolved or absorbed from the moisture in the mold gases and then reprecipitated during solidification.

The pinholes in the smaller sections are quite distinct; whereas some other unsoundness is associated with the pinholes in the two heavier sections. Under these conditions some sand reaction occurs, producing rather dirty metal adjacent to the mold surface and causing rather spongy metal in some locations.

No Gas Absorption

In contrast to this, the metal poured into the mold having low moisture and high A.F.A. permeability did not develop sufficient mold pressure to cause the mold

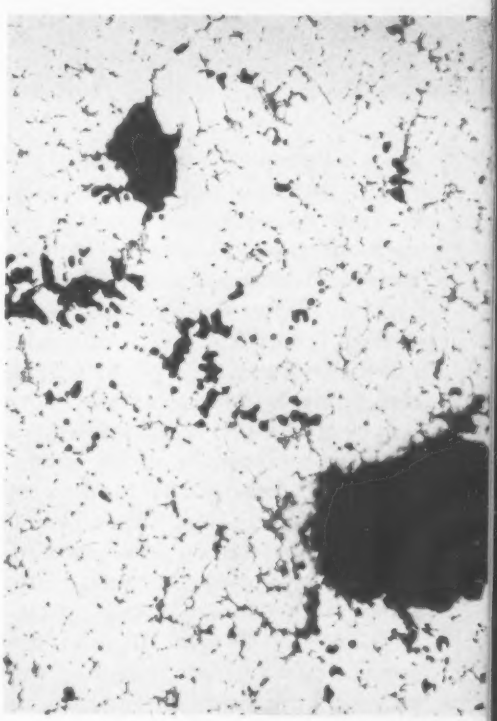


Fig. 39—Photomicrograph showing pinhole porosity grading into microporosity. This aluminum alloy contains 6 per cent Mg, 1 per cent Mn, and 1.5 per cent Cu. ×50.

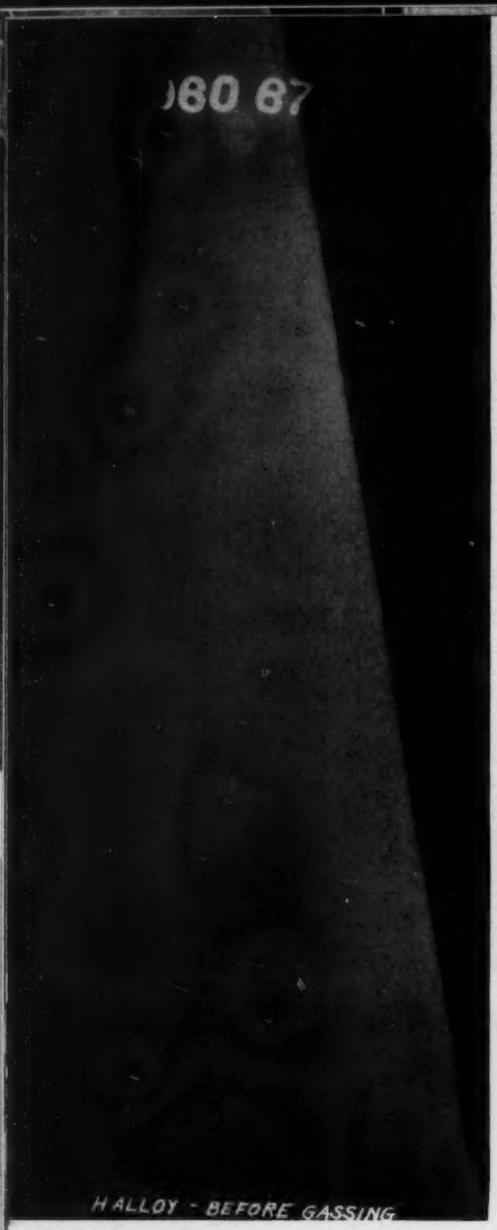
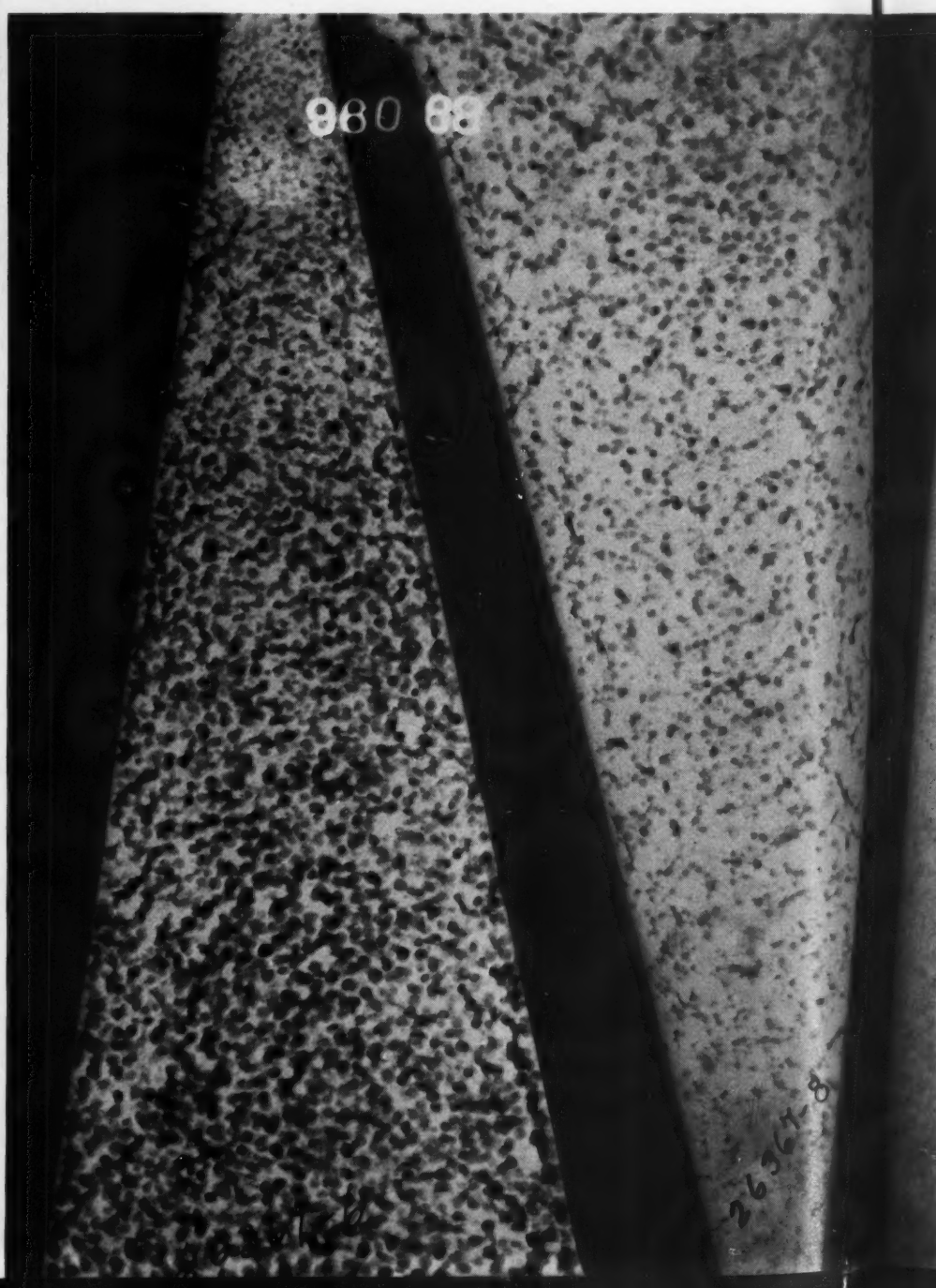


Fig. 40 (left)—Photograph of a triangular panel of ASTM-AZ63 alloy degassed with 0.02 lb of chlorine per lb of metal and poured from 1400 F. This radiograph shows the complete absence of microporosity when the panel is poured from a degassed melt.

Fig. 41 (below)—These two radiographs show the same panel illustrated by Fig. 40, but poured immediately after gassing the melt with hydrogen for 15 min at 1550 F. The other panel shows the same casting after the melt was held at 1400 F for 15 min after the hydrogen gas treatment. These radiographs clearly show the rounded gas holes which, probably because the section is lighter and solidification more rapid, are substantially smaller than those shown by Fig. 1. Even so, these gas holes are much larger than the corresponding pinholes which occur in some aluminum cast alloys. The radiograph at the right shows that, with decreasing gas content, slit-like cavities form near the edges of the panel.



gases to penetrate the melt. As a result, there was no gas absorption because the skin surrounding the melt is good protection against hydrogen absorption unless it is broken. The lesson is obvious. The A.F.A. permeability must be relatively high, at least 15 at the minimum, and the moisture content should be kept low, consistent with the workability of the sand.

Relation of Pinhole Porosity to Microporosity. The accentuation of microporosity by the gas content of the melt in magnesium alloys has been firmly established,[2, 3, 4, 5, 6, 7] and it does not seem necessary to consider this phase of the problem further. As already illustrated by Fig. 1, magnesium alloys are not subject to the formation of pinholes but rather to large gas holes which seldom occur under commercial conditions. When they do occur, however, it will be shown that

Fig. 43 (right)—Radiograph of a panel similar to those illustrated by the preceding three radiographs. This radiograph shows that, after the melt has been held for 2 hr at 1400 F, the gas content has decreased to such an extent that it is probably near or below the maximum gas solubility in the solid alloy near the solidus temperature. As a result, only a very slight amount of microporosity is formed, but this panel is less sound than the one illustrated by Fig. 40 which was poured from a chlorinated degassed melt. This and the three preceding radiographs clearly illustrate how, with a decreasing gas content of the melt, the rounded gas holes gradually decrease in number, form slit-like cavities, and then with a still further decrease in gas content merely cause the formation of microporosity. In this respect, these magnesium-base solid solution type alloys are entirely analogous to the aluminum-base solid solution type alloys such as that represented by composition C (Fig. 3).

Fig. 42 (below)—This radiograph is of the same triangular panel illustrated by Fig. 41, but the panels were poured 30 min and 1 hr, respectively, after the hydrogen-gas treatment, the melt being held at 1400 F. At this temperature, some of the hydrogen gradually escapes from the melt, with the result that there is insufficient gas in the liquid melt to cause the gas holes, illustrated by Fig. 41. Instead, the gas in the melt accentuates the formation of the microporosity (shaded portion).

they may grade into angular slit-like cavities and microporosity.

Aluminum alloys form pinholes as the result of the gas content of the melt produced under commercial operation. It will be shown also that this pinhole porosity may grade off into microporosity, especially in alloys which are largely the solid solution type, but which have a small amount of eutectic. This is well illustrated by Fig. 39, which represents an aluminum alloy containing 6 per cent magnesium, 1 per cent manganese, and 1.5 per cent copper.

Solid Solution Type

This alloy is essentially the solid solution type with a small amount of eutectic liquid forming at the end of solidification. This photograph, at ×50, is of a polished cross section of an ordinary tensile test bar. The polished cross section showed the charac-

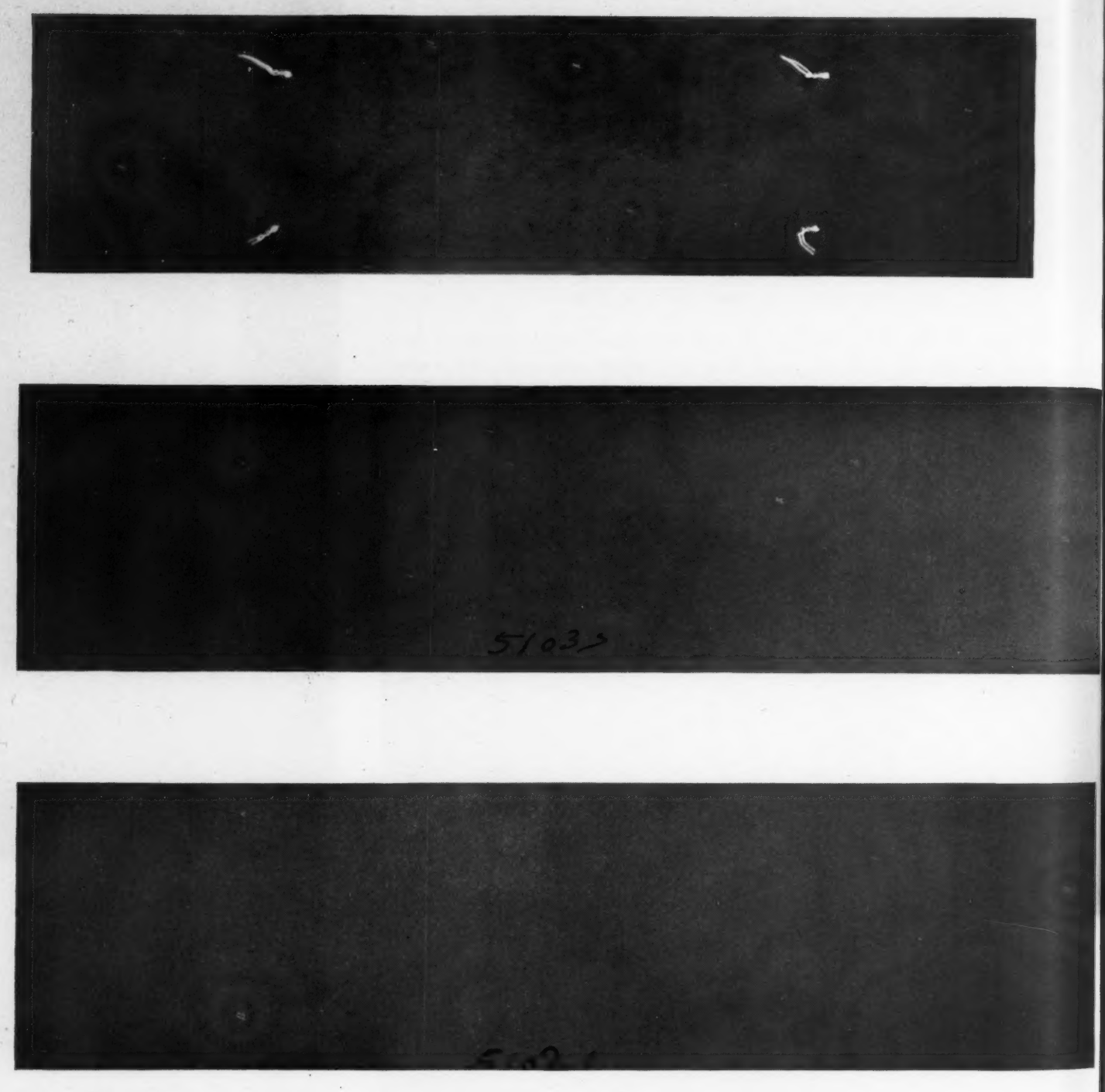


Fig. 44—Radiographic comparison of three panels, each ¾x2x8 in., cast in ASTM-AZ63. Top—Riser ¾-in. thick at the bottom, 1½-in. thick at the top, 2 in. high, 8 in. long. Unchlorinated ASTM-AZ63 alloy superheated for 15 min at 1650 F, and poured at 1450 F in green sand. Center—Same as above, except that the riser was ¾-in. thick at the base, 2½-in. thick at the top, 3 in. high, and 8 in. long. Bottom—Same riser size as employed on the casting illustrated at the top, but the melt was degassed by chlorination. These three radiographs show how microporosity is accentuated by (1) inadequate feeding and (2) the gas content of the melt. In general, the maximum soundness is obtained both by good feeding and melt quality.

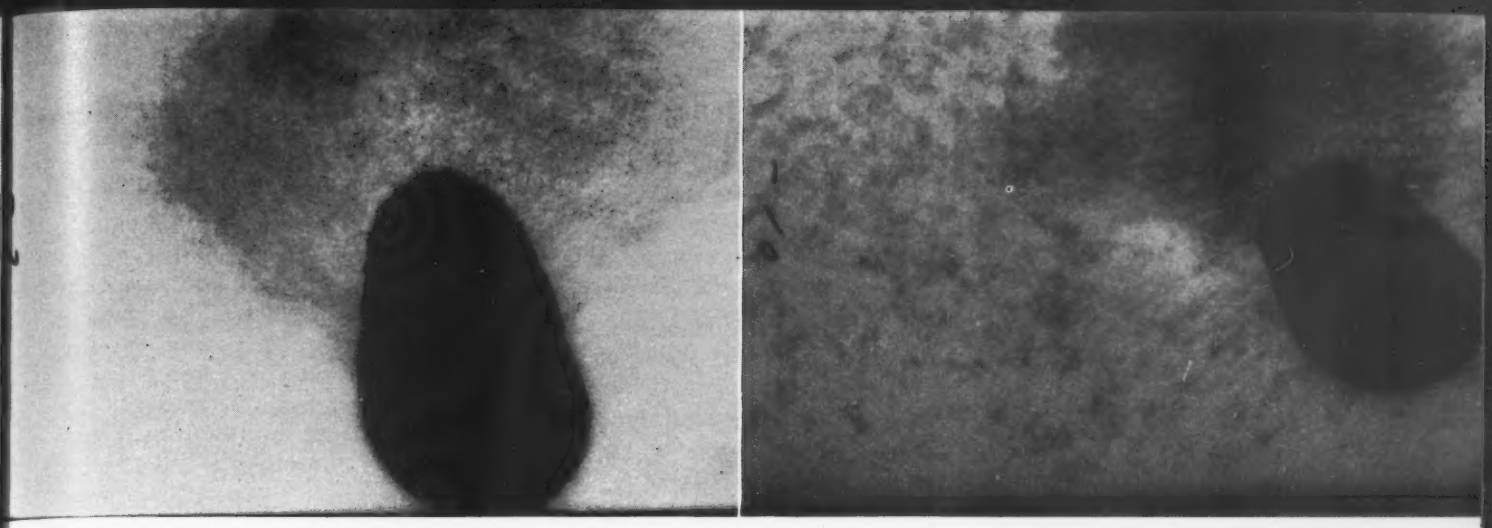


Fig. 45—Radiographs of a ½-in. thick section cut from a riser 1 in. thick, showing the relationship of shrinkage cavity, surface set, spongy shrinkage, and microporosity to the gas content of the melt. Left—ASTM-AZ63 alloy superheated at 1700 F for 15 min, cooled at 1500 F, and then degassed by chlorinating with 0.02 lb of chiorine per lb of melt. Right—Similar to radiograph at left, except that the casting was poured from the melt after passing one cu ft of hydrogen through 250 lb of metal at 1500 F. The radiograph (left) shows the shrinkage cavity surrounded by spongy shrinkage and a surface set at the top. When the melt is gassed with hydrogen, the amount of surface set decreases, the localized shrinkage remains but decreases in size, and there is a large amount of microporosity generally distributed throughout the section.

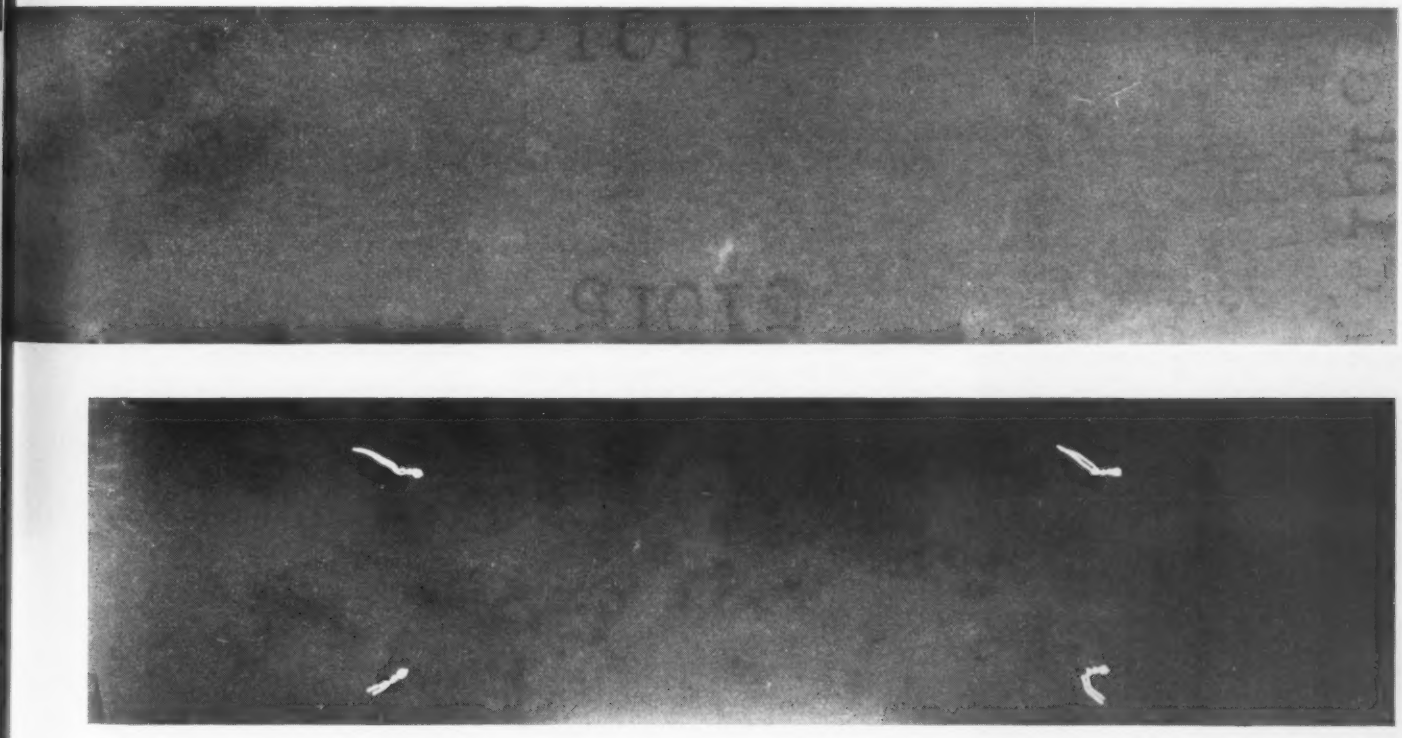


Fig. 46—Radiographic comparison of two similar panels of different thicknesses poured from ASTM-AZ63 alloy unchlorinated, superheated 15 min at 1650 F and poured at 1450 F. Top—⅜-in. panel. Bottom—¾-in. panel. These radiographs clearly indicate the oriented microporosity in the thin section and the unoriented microporosity in the heavier section. These differences probably arise from differences in solidification rates and in degrees of direction solidification, and not in the microporosity formation mechanism.

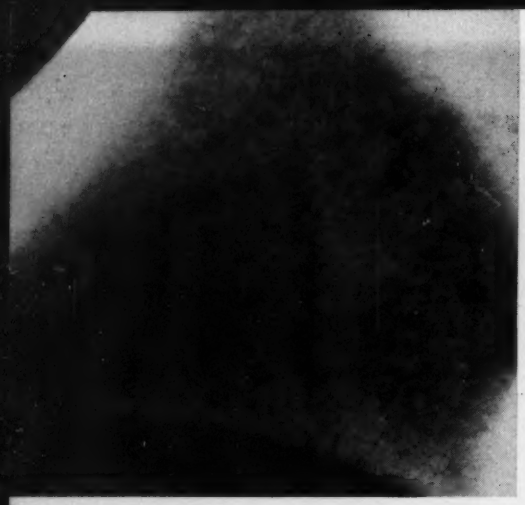


Fig. 47—Radiograph of a thin section of a No. 220 casting showing mottling caused by the coarse-grained structure. This mottling should not be confused with microporosity or pinhole porosity. ×1.

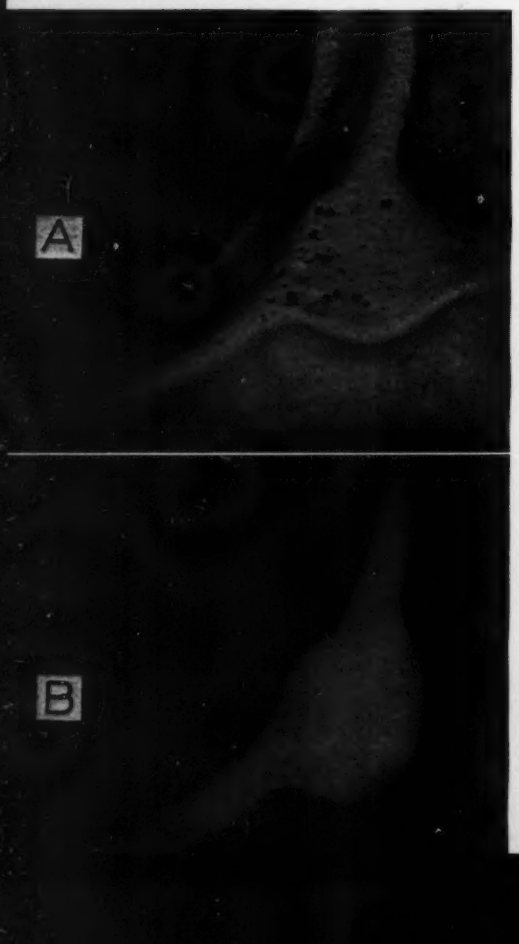


Fig. 48—(A) Photograph and (B) radiograph of a section of a No. 355 alloy crankcase showing "cope dross" on the cope surface. This defect generally is observed after sand blasting and is not related to shrinkage or to gas evolution by the melt. The term "gas holes" should not be applied to this defect because it is misleading. ×1.

teristic generally distributed type of pinhole porosity. Examination under the microscope, however, showed that there was a great deal of porosity associated with these pinholes which approached the appearance of microporosity.

Pinhole Porosity

In fact, in this series of alloys, all gradations can be found between fairly rounded pinholes to rather large areas of generally distributed microporosity, which taken as a whole has the appearance, to the naked eye, of ordinary generally distributed pinhole porosity. Figure 39 shows a pinhole with associated microporosity, and it also shows one of these areas in which the pinhole is an aggregate of more or less widely distributed interconnecting channels, microporosity, between the grains.

It has already been noted that solid solution type aluminum alloys normally do not have pinhole porosity, though they may and sometimes do have this defect. Instead, they are characterized by the presence of microporosity. On the other hand, alloys which solidify over a considerable range of temperature and have a large amount of eutectic solidifying at the end normally have little or no microporosity but are quite subject to pinholing.

On the other hand, alloys such as that represented by Fig. 33, which are intermediate, are characterized by pinhole porosity grading off into microporosity. Such defects as that shown by Fig. 39 can properly be called "pinholes with associated microporosity." This term, though longer, is more accurate and more descriptive than the common one which is applied, namely, "channel porosity." This term is also decidedly to be preferred rather than reference to such defects by the erroneous term, "shrinkage."

Gas Hole Transition

With decreasing gas content of the melt, the transition of gas holes in magnesium castings from rounded shapes to angular slit-like cavities and then to microporosity has been described.[3] This is further illustrated by Figs. 40, 41, 42, and 43, with their captions. The accentuation of microporosity by the gas content of the melt has also been illustrated in a previous publication.[3]

This is further illustrated by Fig. 44, which shows the reduction of microporosity obtained by degassing the melt as well as the improvement obtained by using a larger riser, thus showing that microporosity can be accentuated by either poor feeding or by gas evolution during solidification. Figure 45, with caption, is an illustration of the relationship of shrinkage, microporosity, and gas content in the melt.

Elaborate explanations have been made[6] for the oriented or "layer" appearance of microporosity in magnesium castings, but these seem unnecessary. This oriented appearance is common in thin sections where solidification is rapid and considerably affected by the path of flow of the melt in the mold cavity, giving rise to the oriented appearance of the microporosity. It is not common in heavy sections where the direction of solidification is less dependent upon the path of flow of the melt in the mold cavity (Fig. 46).

Mottling

Mottling is a term applied to the appearance of radiographs which show the grain structure. An example of this is shown by Fig. 47, which is a thin section of a No. 220 alloy casting having a nominal composition of 10 per cent magnesium in aluminum. Mottling, showing the grain structure, is not a defect, and should not be confused with pinhole porosity or with microporosity when interpreting radiographs.

However, it must be admitted that when mottling occurs with either of these two defects, proper interpretation of the film becomes difficult. Other examples of mottling were illustrated by composition *A* of Fig. 4, and by Fig. 11. In general, mottling is more apparent the thinner the section radiographed, the coarser the grain, the better the contact of the film with the casting, and with other features which improve the sensitivity of radiography.

The exact cause of mottling has never been precisely proven, but it is clearly associated with the

grain structure. It does not show a defect in the casting, except insofar as it reveals the existence of coarse grains.

Cope Dross. One illustration of cope dross is included not because it is in any way associated with shrinkage or with the gas dissolved in the melt, but because cope dross is frequently called "gas holes." This defect is, on the contrary, a result of turbulence during the pour, or from pouring improperly skimmed melts.

When an easily oxidizable melt, such as aluminum or magnesium, is poured in such a way that some turbulence occurs, some oxidation of the melt takes place. This oxide becomes entrapped in the metal with a certain amount of air, forming a "froth" consisting of these three materials—oxide, air, and the metal of the melt.

Because of the air present, the over-all density of this froth is low and as a result tends to rise to the surface. For this reason, this defect invariably occurs on cope surfaces and may not be entirely visible until the casting has been sandblasted. Figure 48 shows a photograph *A* and a radiograph *B* of a section of a crankcase of No. 355 alloy containing this defect on the cope side of the casting.

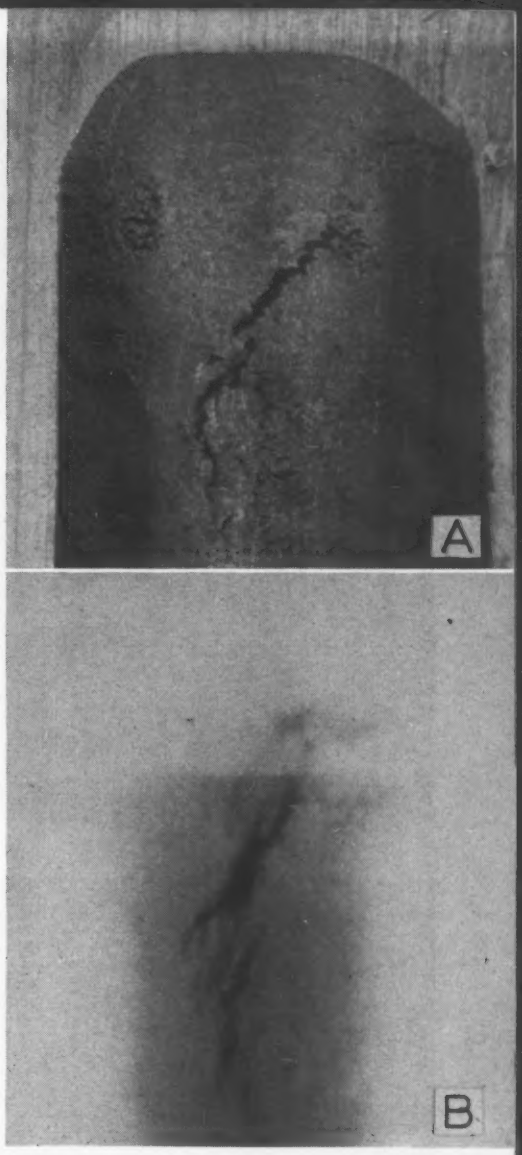


Fig. 50—(A) Photograph and (B) radiograph of a 1-in. thick section of an inadequately fed No. 355 alloy impeller casting. This crack resulted from shrinkage and is properly called a "shrinkage crack," not a "hot crack." ×1.

Cope Dross

This defect is frequently referred to as "gas holes." However, it is believed that because the term "gas holes" is used for other types of defects it would be better to refer to this one as cope dross since (1) it occurs mainly on the cope side, and (2) the defect is not caused by gas but by a mixture of metal, gas, air, and oxide which together constitute dross.

It is frequently stated that internal stresses produce microporosity. Internal stress applied to a hot casting will cause a hot crack, a typical example of which is illustrated by Fig. 49. This figure shows a radiograph *A* of a small No. 195 alloy, cored cylindrical housing showing a hot crack with a eutectic filling in part of the crack. This eutectic-filled portion of the crack appears as a fine white line because it has high density, whereas the unfilled portion of the crack appears as a dark line.

The partially filled portion of the crack is shown by the photograph (*B*) at ×100 of a section from the casting in which the crack was filled with the copper-rich eutectic liquid. The cavities remaining in this hot crack may resemble those of microporosity. However, it is not desirable to call this microporosity because its origin is quite different. This alloy, No. 195, is quite hot short, and the hot crack shown by Fig. 49 is representative of a condition that can result from employment of an improper method of foundry practice.

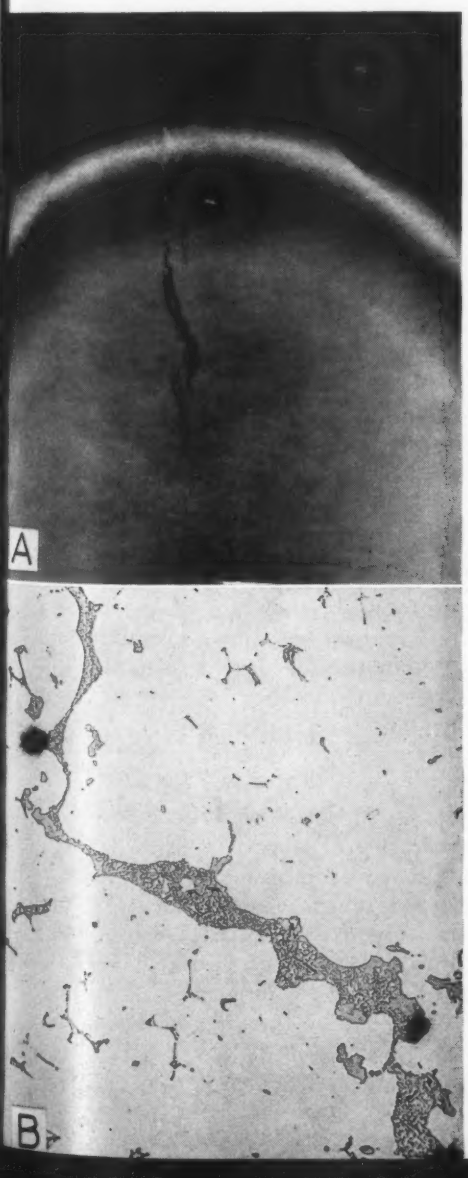


Fig. 49—(A) Radiograph of a small No. 195 alloy, cored cylindrical housing showing a hot crack partly filled with eutectic. ×1. (B) Photomicrograph of the above-illustrated crack showing the eutectic filling in a portion of the defect. The unfilled portion might resemble microporosity but should not be confused with it. ×100.

Shrinkage Cracks

Cracks can also occur in alloys which are not particularly hot short. This is well illustrated by Fig. 50, which is a photograph (*A*) and a radiograph (*B*) of a 1-in. section of an inadequately fed No. 355 alloy impeller casting. However, this defect is associated with obvious shrinkage and, therefore, this crack should not be called a "hot crack" but, on the contrary, it should be referred to as a "shrinkage crack."

The reason is obvious. If the inspector or metallurgist calls such a defect a hot crack, the foundryman would normally proceed to reduce

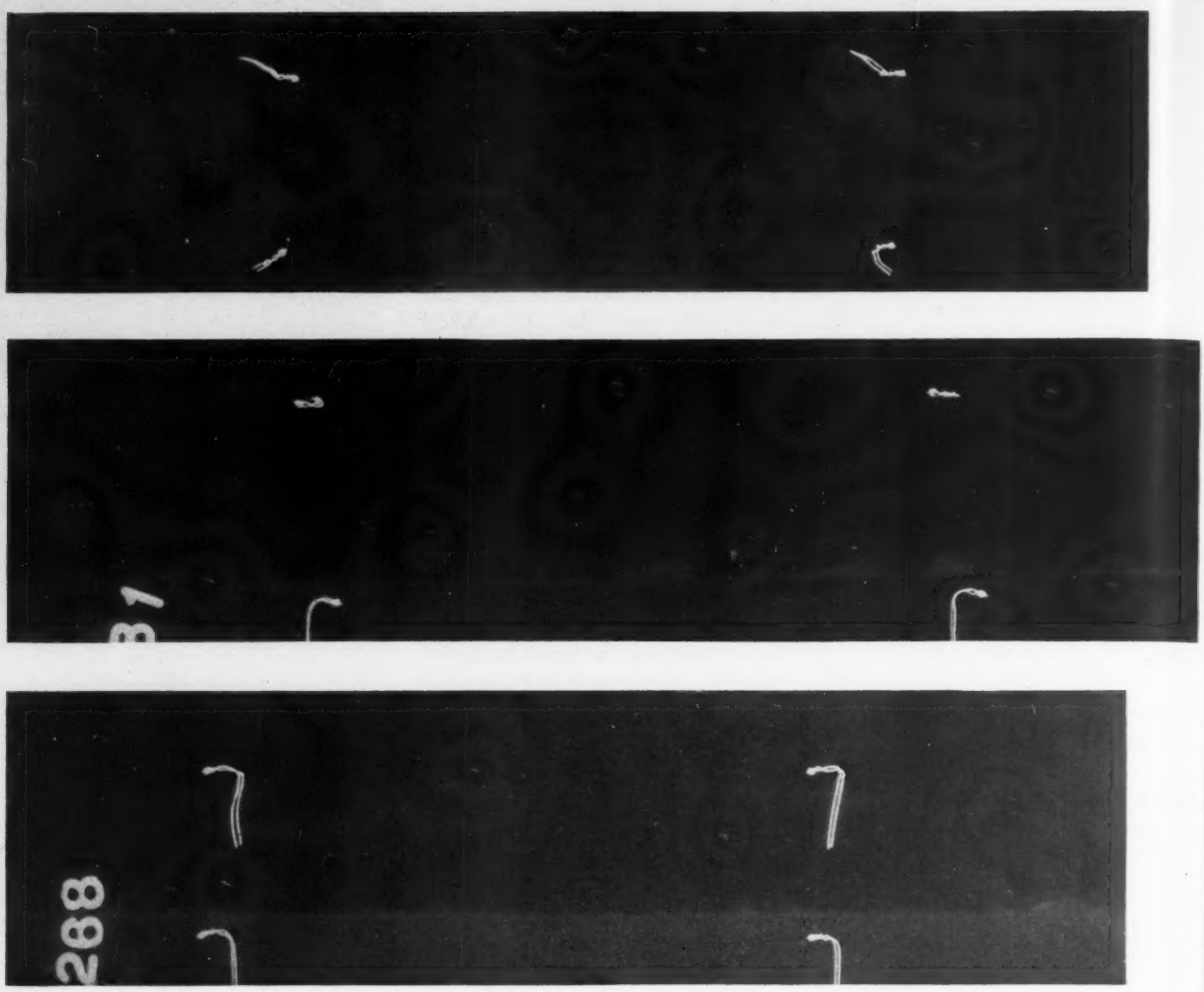


Fig. 51—Radiographic comparisons of panels ¾x2x8 in. having a riser ¾-in. thick at the base and 1½ in. thick at the top, 2 in. high and 8 in. long, poured from ASTM-AZ63 alloy, not chlorinated, superheated for 15 min at 1650 F, and poured at 1450 F. Top—Cast in green molding sand. Thermal gradient, 15 F per in. Center—Cast against a graphite chill. Thermal gradient, 58 F per in. Bottom—Cast against a cast iron chill. Thermal gradient, 171 F per in. These three radiographs clearly illustrate the reduction in microporosity obtained by increasing the temperature gradient. A high temperature gradient reduces the thickness of the mushy zone, thereby reducing the amount of the microporosity as described elsewhere.[2]

the internal stress of the hot casting, perhaps by making a softer core. It is obvious that this terminology would be misleading to the foundryman, whereas, if the metallurgist or inspector properly labeled the defect as a shrinkage crack, the foundryman would correct it by more adequate feeding of this portion of the casting.

Permanent Mold Castings

All of the illustrations, except Fig. 51, included in this paper are of sand castings. Similar defects may occur in permanent mold castings, excepting, of course, the defects arising from gas absorption from the mold, as illustrated by Fig. 38. In general, permanent mold castings solidify more rapidly and with steeper temperature gradients than sand castings.

As a result (1) the gas porosity tends to be finer, more rounded, and more numerous, (2) the localized shrinkage tends to be more localized with a smaller volume of spongy metal adjacent to the main shrinkage cavity, and (3) as a corollary of Item 2, microporosity occurs to a lesser extent.

This is partly a result of increased temperature gradients and partly because aluminum permanent mold alloys invariably form a considerable amount of eutectic. The magnesium alloys selected for permanent mold use are also of the type which are least subject to the formation of microporosity.

Solidification Rate

The effects of solidification rate upon the occurrence of pinhole porosity in aluminum and gas holes in magnesium alloys have been mentioned. Figure 51 is an illustration of the relationship of the degree of directional solidification as affected by the steepness of the

temperature gradients in the solidifying casting and the occurrence of microporosity in the casting.

A number of defects which may occur in aluminum and/or magnesium castings have been illustrated. In general, the terms applied to these defects as nearly as possible convey to the foundryman the exact cause of the trouble. Accordingly, the terms applied to these defects have been of a nature which describes their appearance and indicates their cause. Where the cause is not definitely known, a term is used which is descriptive but which does not give the foundryman an erroneous impression as to the cause of the defect.

In general, the type of defect produced by shrinkage and/or the evolution of gas in light-alloy melts depends mainly upon (1) the alloy composition, (2) the gas content of the melt, and (3) the manner of solidification and the degree of directional solidification as determined by casting design, section thickness, and gating method, etc. Depending mainly upon these factors, localized shrinkage grades into microporosity, and gas porosity may also grade into microporosity so that no hard and fast lines of demarcation are formed.

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N. F. HINDLE LEAVES A. F. A.
To Enter Engineering Education Field

NORMAN F. HINDLE, a member of the A.F.A. staff since 1933 and on leave of absence as Director of the A.F.A. Technical Development Program for the past year, has resigned from the Association to become Associate Professor of Mechanical Engineering at the University of Idaho, Moscow.

On graduation from Purdue University in 1925, he became connected with American Steel Foundries, first as laboratory chemist at the Alliance, Ohio, plant, then as chief chemist at the Indiana Harbor, Ind., plant. Between 1928 and 1931 he served as assistant editor of *The Foundry*, Cleveland. He returned to American Steel Foundries in the latter year as chief process inspector and became Staff Assistant with A.F.A. in 1933.

During his many years as a member of the National Office Staff, Norm became known to thousands of foundrymen throughout the industry by reason of his intense interest in the development of technical and practical writings, as well as his contacts with and developmental work in the early years of A.F.A. chapters. In recent years, his activities along educational lines, and especially toward the integration of college engineering courses and their influence on young men available to the foundry industry, assumed importance.

Under the leadership of Bob Kennedy, Norm played an important part in organizing the technical programs at the Annual A.F.A. Conventions as Staff Assistant, Assistant Technical Secretary (1936-38), Technical Secretary (1938-40), and Assistant Secretary (1940–44).

N. F. Hindle

In 1944 he was appointed Director of the newly formed Technical Development Program. This program, encompassing all the technical functions of the Association, was instrumental in developing such outstanding publications as the CORE BOOK, CAST METALS HANDBOOK, SYMPOSIUM ON CENTRIFUGAL CASTINGS, and several symposia on malleable iron.

It is expected that he will assume his new duties at the University of Idaho effective with the semester now beginning.

Moving Day For National Office

ON FEBRUARY 15 the National Office staff moved "bag and baggage" from rooms 1398 and 1265, Adams-Franklin Building, 222 West Adams St., Chicago 6, Ill., to room 1198, Adams-Franklin Building, 222 West Adams St., Chicago 6, Ill. The new offices, situated on the 11th floor, provides for more efficiency and convenience in the Association's operation.

The Association's telephone number remains unchanged—Randolph 8751.

Plan Milan Fair

AN INTERNATIONAL SAMPLE FAIR at Milan, Italy, scheduled for April 12 to April 25, is expected to feature wide-spread participation of American firms, according to J. B. Erskine, 135 S. La Salle St., Chicago, who has been named by Fiera Di Milano to handle arrangements in this country. Castings and castings equipment will be exhibited.

A.F.A. DIRECTORS REVIEW

Progress and Plans

At Mid Year Board Meeting

CONVENING at the Palmer House, Chicago, on Thursday, January 23, the A.F.A. Board of Directors reviewed the activities of the current fiscal year and pointed the way toward further progress. Prominent in their deliberations was the program for the 51st Annual Meeting of the Association, in Detroit, April 28-May 1.

National President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, presided. Also present were Vice-President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., and Directors F. J. Walls, International Nickel Co., Detroit; F. J. Dost, Sterling Foundry Co., Wellington, Ohio; L. C. Wilson, Reading, Pa.; H. G. Lamker, Wright Aeronautical Corp., Paterson, N. J.; B. L. Simpson, National Engineering Co., Chicago; H. A. Deane, American Brake Shoe Co., New York; S. C. Wasson, National Malleable & Steel Castings Co., Chicago; J. E. Kolb, Caterpillar Tractor Co., Peoria, Ill.; G. K. Dreher, Rogers Pattern & Foundry Co., Los Angeles; E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md.; Jas. H. Smith, General Motors Corp., Saginaw, Mich.; and H. H. Judson, Standard Foundry Co., Worcester, Mass.

In connection with registration fees at the Detroit meeting, the Board voted to continue its policy of requiring no registration fee from Association members, but charging a fee (which will be $2.00 this year) to individuals not holding membership. It was agreed, however, that such registration fee could be applied on membership taken out at the Convention or within a limited period thereafter.

The Board heard a report on the success of bringing the winners in the 1946 National Apprentice Contest to the 50th Anniversary Convention in Cleveland and a recommendation that this be made a regular convention policy. As a result, a definite plan was set up for attendance of winning apprentices at the Detroit meeting, in cooperation with A.F.A. chapters.

Membership

A report on membership was submitted, showing a total of 1,004 new members added since June 30, 1946, bringing the total membership on December 31 to 8,909. The work of the chapter membership

(Continued on Page 91)

At Mid-Year Meeting of A.F.A. Board: clockwise, F. J. Dost, E. W. Horlebein, L. C. Wilson, F. J. Walls (fifth from left), H. H. Judson (seventh from left), Vice-President Max Kuniansky, President S. V. Wood, J. E. Kolb, H. A. Deane (fifth from right), S. C. Wasson, H. G. Lamker, B. L. Simpson, G. K. Dreher; Secretary-Treasurer Wm. W. Maloney (seventh from right), Technical Director S. C. Massari (sixth from left).

MAKING PERMANENT MOLDS

Vincent J. Sedlon
President
Master Pattern Co.
Cleveland

An outline of the skills and facilities necessary for successful production of permanent molds for aluminum castings . . . the problems encountered are presented in a progressive manner. The author does not attempt to justify the use of permanent molds, nor is a comparison made with other production methods.

HEAVY DEMAND for permanent molds has thrown this type of work into inexperienced hands, and the results usually are unsatisfactory because insufficient knowledge of the process and problems necessitates costly experimentation. In our specialized industrial era we do not call upon a carpenter to make patterns or a machinist to do the work of a diesinker.

Permanent moldmaking requires a close coordination of specific knowledge and many related skills as a foundation. These fundamentals are: (1) a knowledge of foundry practice such as gating, risering, pouring and venting; (2) a knowledge of wood patternmaking to construct patterns utilized to produce castings for the mold and the development of working models for experimentation as well as models which are used for transferring the shape to the mold parts; (3) the knowledge and experience of a metal patternmaker, resourceful in the use of machinery for cutting the mold cavities and all the other metal parts of the mold, and versed in laying out and setting up the work, making special tools, and assembling the complete unit.

The successful operation of a mold depends upon proper design. Therefore, the experience of the designer is reflected in the mechanical operation and productivity of the mold as developed.

In the planning of these molds a careful study is made of the casting to be produced. The wall thickness, heavy sections, and all other problems such as gating, risering, venting, coring, shrinkage, draft angles, parting, ejection, heat radiation and the general opera-

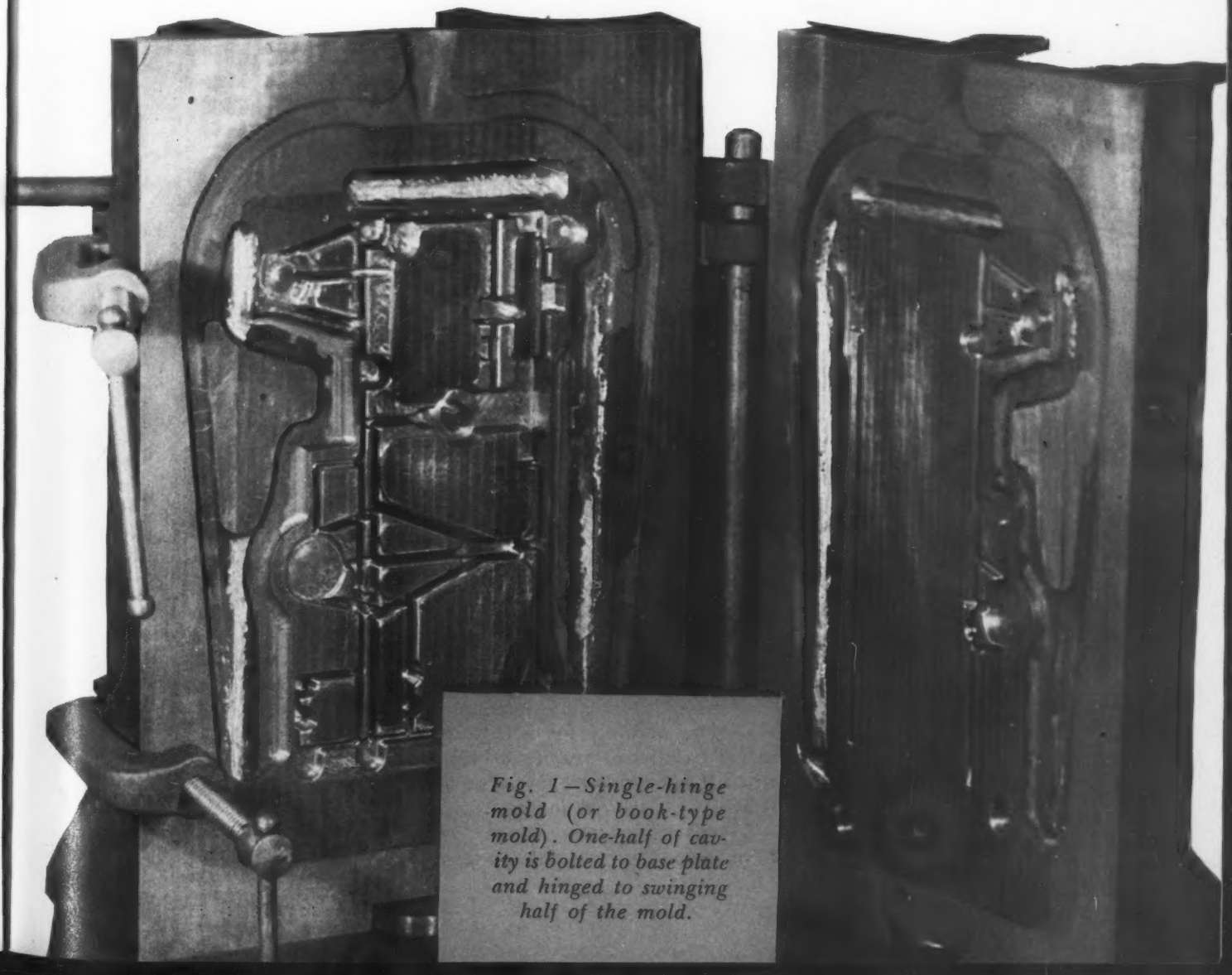


Fig. 1—Single-hinge mold (or book-type mold). One-half of cavity is bolted to base plate and hinged to swinging half of the mold.

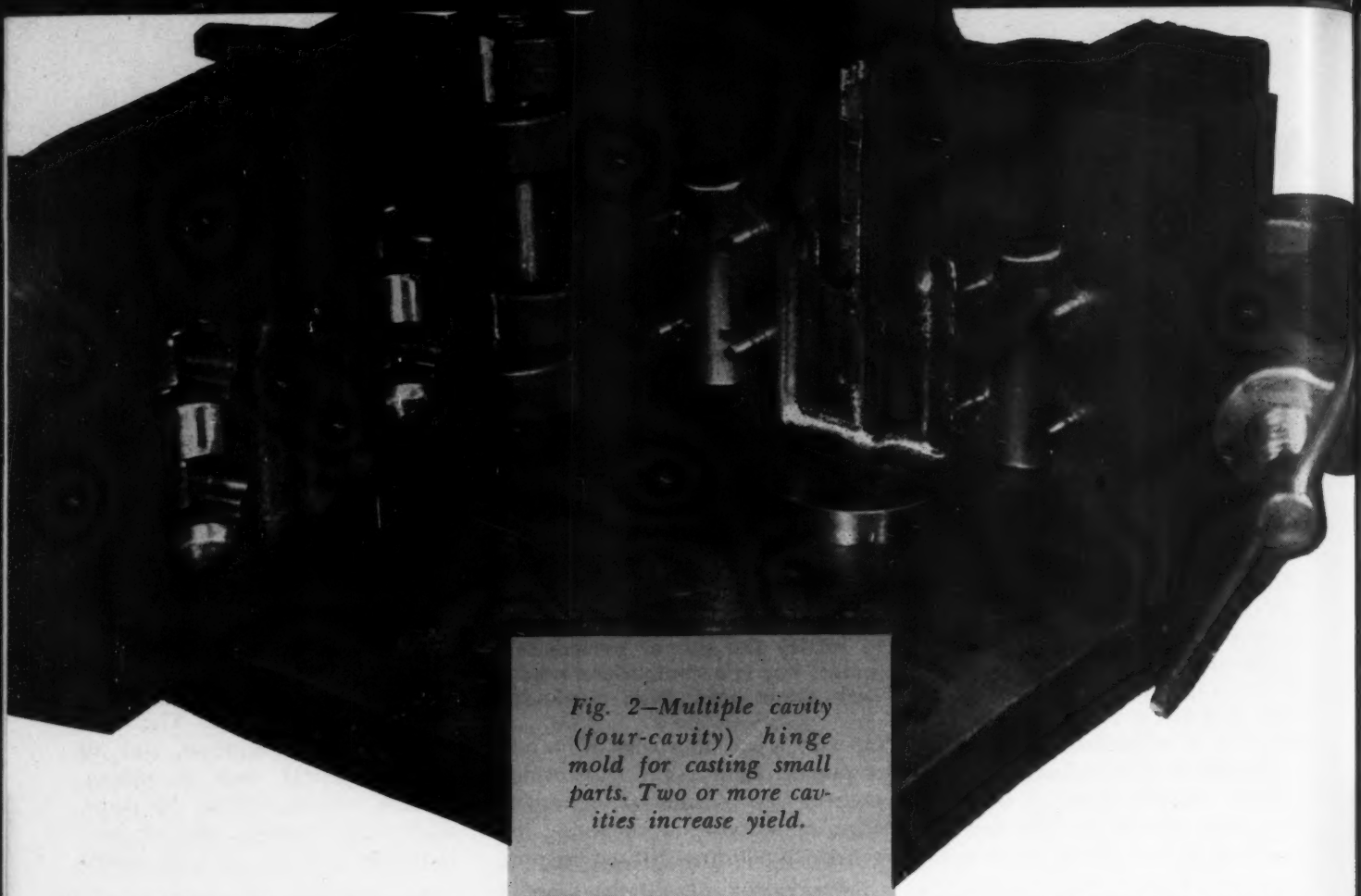


Fig. 2—Multiple cavity (four-cavity) hinge mold for casting small parts. Two or more cavities increase yield.

tion of the mold must be considered. These plans then lead to the positioning of the cavity in the mold in order to obtain the best results in pouring. When ascertained, a drawing is made and submitted to the wood patternmaker.

A distinct advantage in having a wood pattern department is that the patternmaker is able to cooperate with the designer in the development of the mold. Patternmaking is closely related to moldmaking because many problems such as metallic construction, proper draft, type and length of core prints, suitable coreboxes and driers, adequate finish allowances, etc., are common to both.

This knowledge is not only invaluable—it is indispensable. In the case of complicated molds, a full size working model is made of wood. This enables the designer to study the operation of the mold and make improvements. After the model has served its purpose, the patternmaker can utilize it by adding the necessary stock for machining and convert the model into a pattern for the production of the mold casting.

While on the subject of models, it should be mentioned that wood models are also made to develop the odd shapes and contours of the cavities. It is easier to develop the difficult nongeometrical shapes and blends in wood and then use these models to machine the cavities by the follower or duplicating method.

After the mold castings have been made from the wood pattern, they are finished in another department. The personnel of this department consists of metal patternmakers. Their equipment is a combination of machines especially selected for mold work, including planers, shapers, milling machines, lathes, surface grinders, etc.

The moldmaker is capable of working on any of the machines and moves progressively from one to another to finish the various parts of the job. He is a highly specialized craftsman, trained in patternmaking, and applies this knowledge and skill to the related business of permanent moldmaking. The necessity for a patternmaker's skill can readily be seen when it is considered that a mold is actually a pattern in reverse.

Summarizing the talents, we have wood and metal patternmakers, coordinated by the designer who is proficient in both crafts and who also has permanent mold experience. For efficiency it is important that this group of men cooperate, understand moldmaking procedure, are capable of reading blueprints, and know what part of the mold they are making and how it will function.

Facilities for moldmaking are a wood pattern shop, a well equipped metal pattern shop, an engineering department, and the equipment to prove the completed mold.

Problems. The question of whether the castings should be made by permanent mold or by sand presents a problem to many buyers. It is interesting to note that a recent business publication states that 42 per cent of the aluminum castings now made are produced by the permanent mold method of casting.

As the demand for this economical method of making castings increases, the attitude of many foundrymen will change from indifference to avid interest; from a reluctance to an eager desire to take an active part in it. However, many castings, because their character involves a great deal of coring, or because of large proportions or

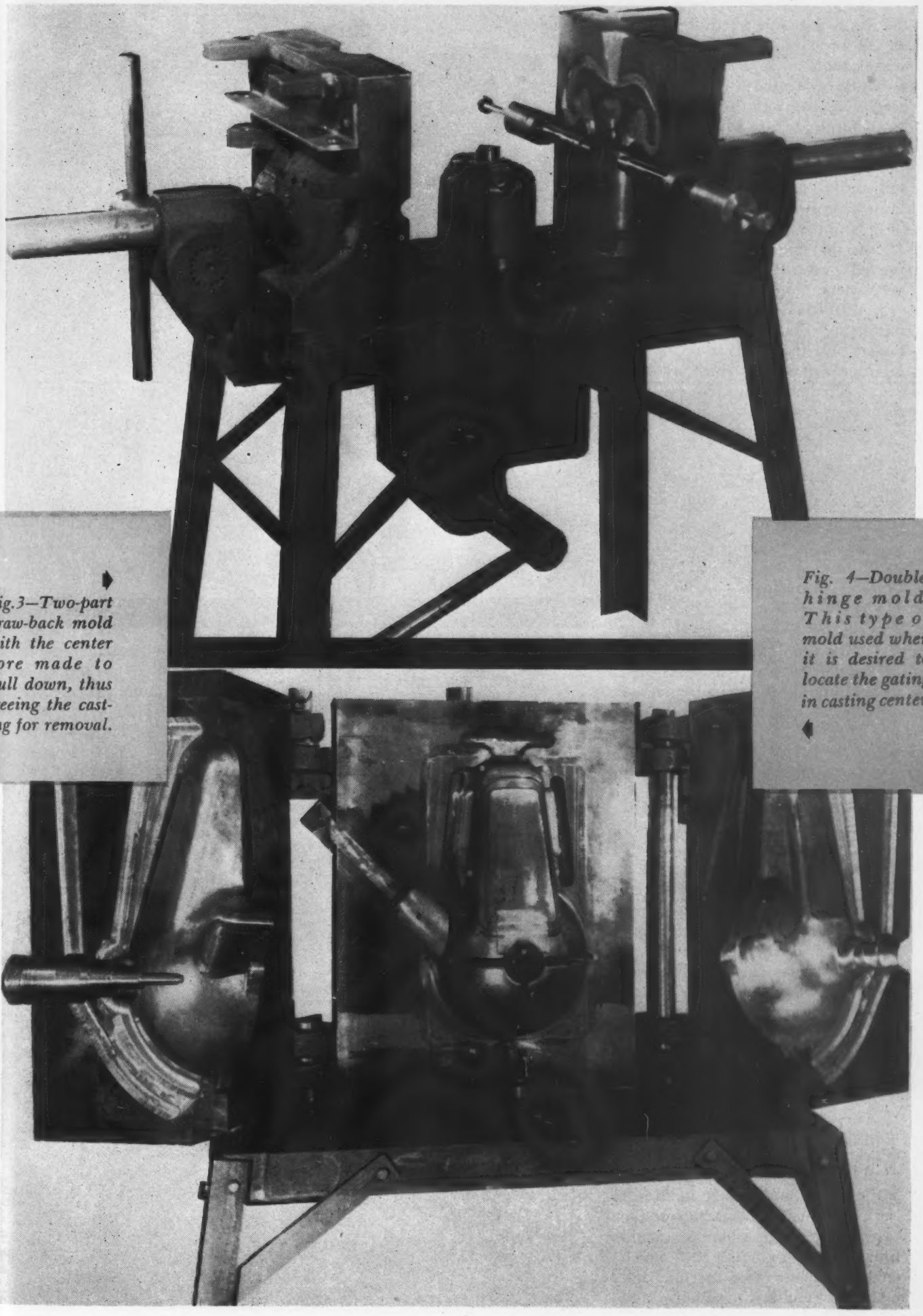


Fig. 3—Two-part draw-back mold with the center core made to pull down, thus freeing the casting for removal.

Fig. 4—Double-hinge mold. This type of mold used when it is desired to locate the gating in casting center.

the limited number required, will in all probability continue to be cast in sand.

Those in contact with prospective casting buyers should be able to determine the advisability of either method and so inform the purchaser. In order to do this intelligently, the following questions must be answered:

1. Number of castings?
2. Is the smoother finish or improved outward appearance of a permanent mold casting an asset?
3. Will the closer dimensional uniformity of a permanent mold casting save machining time, polishing time, or assembly time?
4. Will there be a saving in the cost per casting by permanent mold (mold cost prorated) or will the cost per casting by pattern (pattern cost prorated) be lower?
5. Are physical properties of a permanent mold casting desirable?

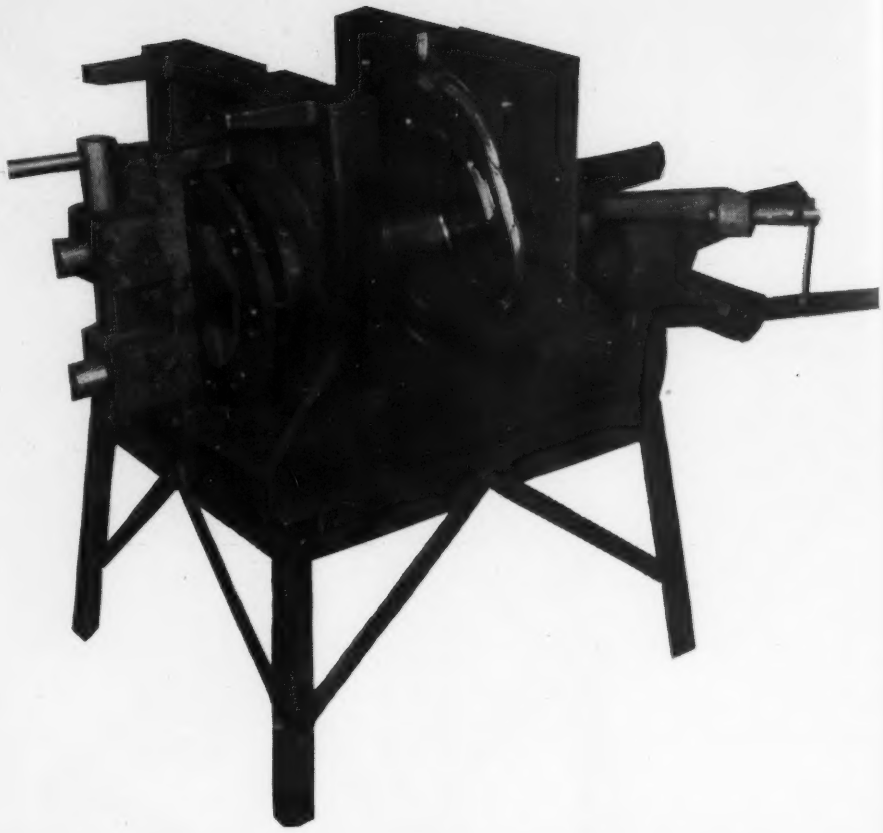


Fig. 5—Two-part drawback mold with stationary side. Ejection mechanism is located in the back part of the mold.

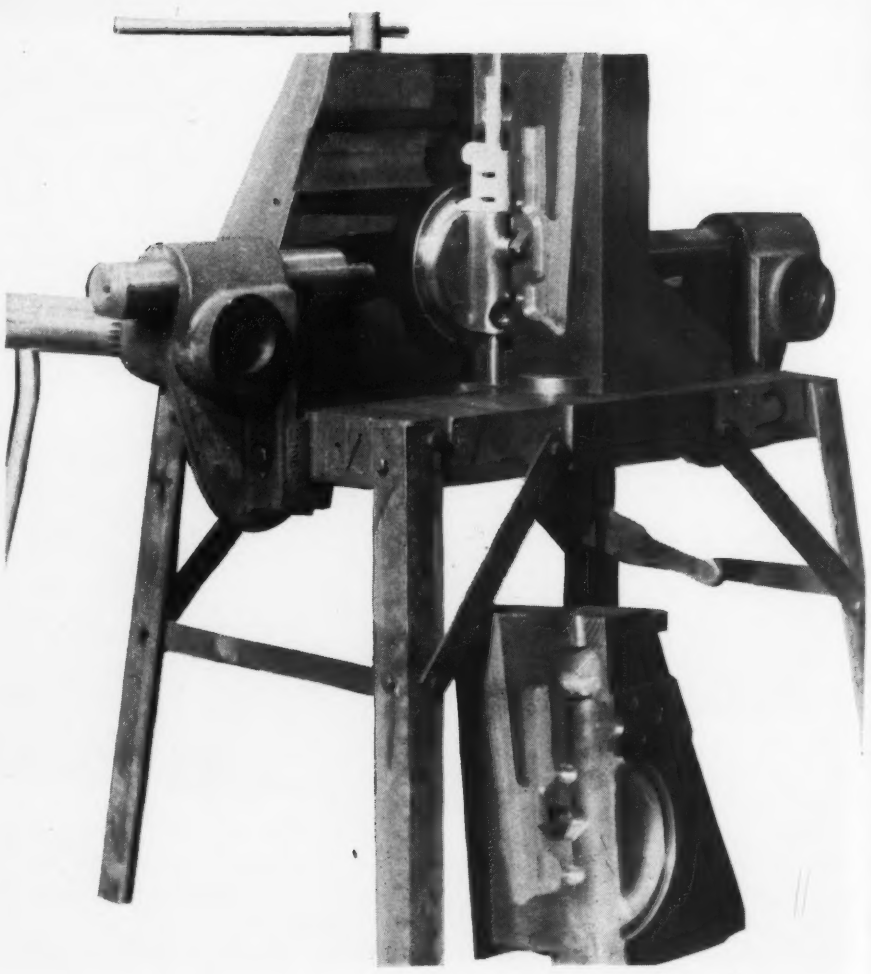
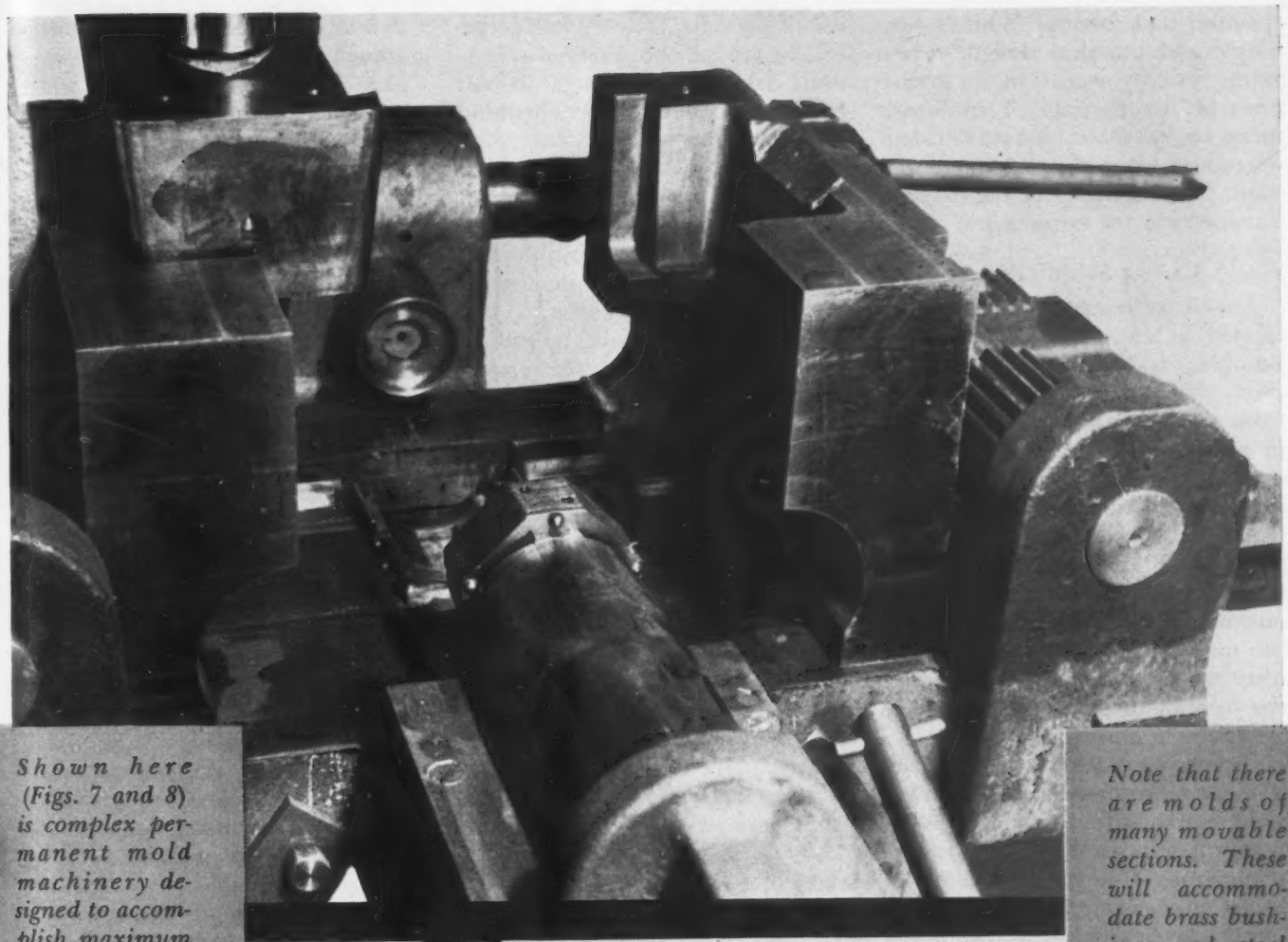


Fig. 6—Three-part drawback semipermanent mold with one section removed to show dry sand core in position.

After analyzing the foregoing, common sense dictates which method shall be used. In some instances the foundryman can well afford to invest in a mold and liquidate the investment by the savings which result from increased production.

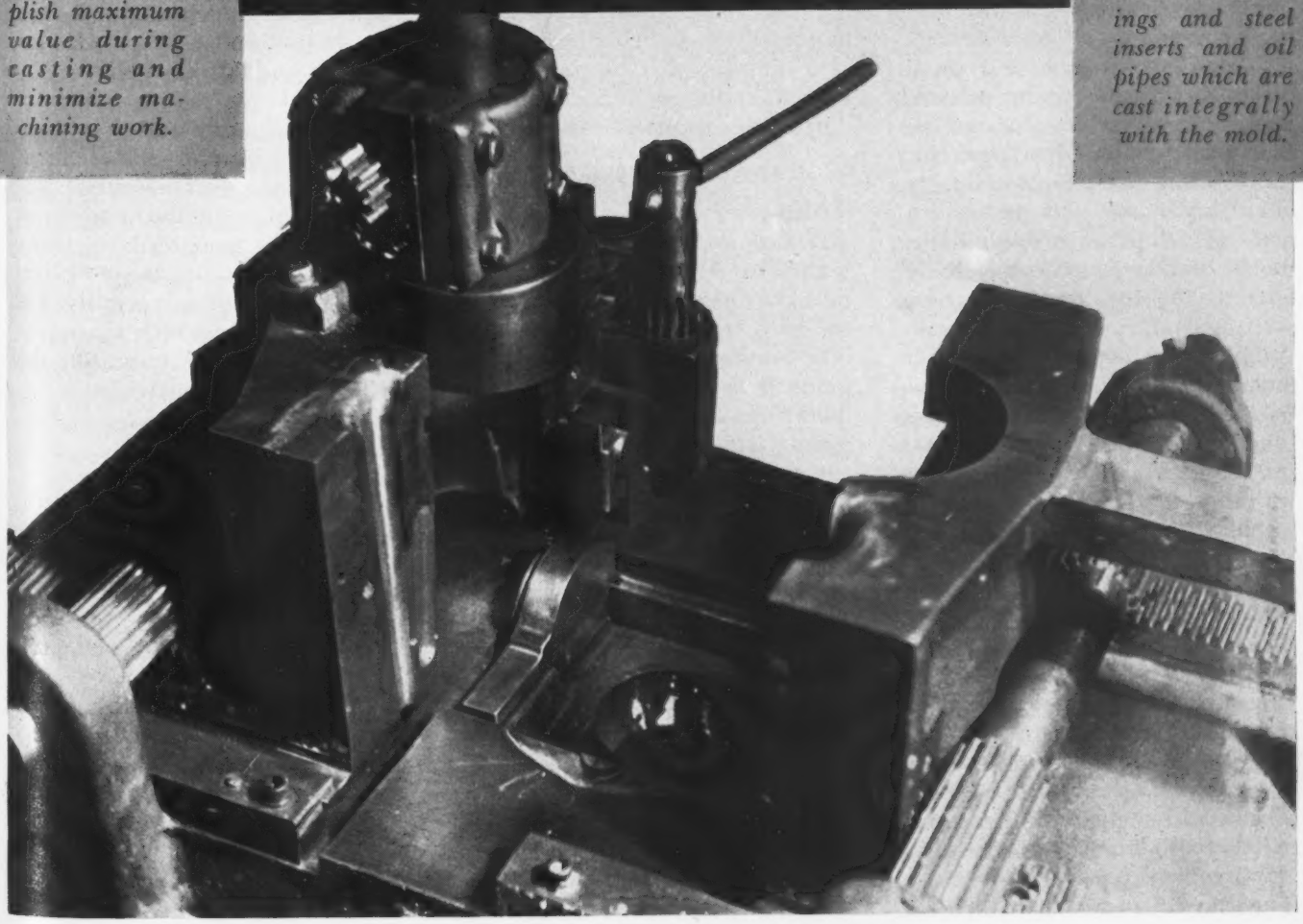
Mold Construction Practice. While there is no standard form or design for molds because of the varied shapes and sizes of the castings to be made, a large percentage of the molds fall into general patterns. The most common types are:

Figure 1. Single-hinge mold (or book-type mold). One-half of the cavity is bolted to a base plate and hinged to the swinging half, which enables the operator to close and open the mold for pouring and



Shown here (Figs. 7 and 8) is complex permanent mold machinery designed to accomplish maximum value during casting and minimize machining work.

Note that there are molds of many movable sections. These will accommodate brass bushings and steel inserts and oil pipes which are cast integrally with the mold.



ejecting the casting. This is a simple and practical design. The gating usually is cut in on both sides of the parting. The down sprue on all molds should be designed to permit of a steady or constant, gradual filling of the cavity, starting near the bottom.

Casting Solidification

A well or reservoir generally is located as close to the cavity as possible, usually ¼-in. from the cavity. This well provides a source from which the casting may draw in process of solidification. Risers usually are located at the top to insure the filling of the cavity at this point and to act as a shrink bob. Small holes or vents are provided at places where the air would not otherwise escape in advance of the molten metal. Ejector mechanism when necessary is bolted on the back of the stationary half.

Figure 2. Multiple cavity (four-cavity) hinge mold for small parts. Two or more cavities increase the yield per pouring, and this is a practical approach to casting cost reduction. However, there are limits of efficiency in this practice, commonly referred to as diminishing returns.

Often the operator of a small, two-cavity, easily operated mold may produce more castings per day than the operator of a larger and cumbersome four-cavity mold. In some instances it is more economical to provide two smaller molds, both of which can easily be operated by one man, alternating pouring and ejecting operations.

Figure 3. Two-part draw-back mold. The two halves are drawn back from a closed position in the center to enable the making of a casting with a movable iron core which, when drawn down by means of the lever, will free the casting for removal.

Gating Location

Figure 4. Double-hinge mold. This type is used whenever it is advantageous to locate the gating in the center of the casting. The hinges on these molds may be cast integrally or bolted on. The hinge pins should be made with approximately 0.030-in. clearance to allow freedom for expansion of the mold. The illustration also introduces the use of pry-outs. These loose pieces are used to core out holes of a back-draft nature and are made to pull out independently before the mold halves are opened.

Figure 5. Two-part draw-back mold with a stationary side. After the molten metal is poured and becomes solidified, the movable half is drawn back; and while the nature of the casting causes it to cling to the stationary half, it will be ejected by means of the ejector mechanism in the mold back.

Figure 6. Three-part draw-back semipermanent mold with one section removed to show the sand core in position. The prefix "semi" denotes the use of a sand core in conjunction with the mold. Sand cores are used wherever iron or steel cores cannot be extracted from the casting. This design enables the operator to set a dry sand core as well as a steel insert, and it also accommodates the gating of the casting at the two center bosses.

Figures 7 and 8. These illustrations show molds of many movable sections to accommodate steel inserts, brass bushings, and oil pipes which are cast integrally.

From these basic designs the moldmaker's imagination travels into infinite variations, each in turn a challenge to his ability to design a workable machine.

Construction Simplicity

Molds are subject to hard usage and must be sturdily constructed. Simplicity is essential because delicate loose pieces will not withstand the hard treatment of production. The construction should be well planned to eliminate breakdowns. Therefore, it is well to provide substantial ribbing to prevent breakage and warping and heavy walls to retain the cavity inserts.

Molds should be designed to enable the operator to take them apart with ease; this is necessary for cleaning the mold or replacing broken and worn parts. Sturdy "C" clamps to lock the mold halves should be mounted in a convenient position. All handles or levers must be conveniently located for ease of operation.

A close grained, easily machineable gray iron provides a satisfactory material for mold halves and cavity inserts. The larger castings should be heat treated to stabilize growth or expansion of the casting and to minimize warpage when subjected to alternate heating and cooling during operation.

Also to be considered is the problem of shrinkage or the contraction of molten metal as it solidifies. No set rule can be used to determine the contraction allowance. Although 0.100-in. per ft generally is used, deviations are made depending upon the casting character.

Shrinkage Allowance

In a semipermanent mold where a sand core is used, the 0.100-in. per ft value is fairly reliable, but when the metal solidifies around an iron or steel core its shrinkage is unpredictable, and the amount depends upon the stage of solidification at the instant the core is ejected. Usually, 0.030-in. per ft is estimated on a metal core.

Proving the Mold. It is a rare occasion when a good casting is poured in the first few attempts. Permanent molds are temperamental and require adjustments. In preparing the mold for casting, the smooth surface of the cavity is lightly sand blasted. The mold is then heated and a prepared coating is sprayed into the cavities. Another insulating coating is heavily applied to the gate and riser channels, and a graphite lubricant is applied to the working parts.

The mold is preheated to about 600 F and is then ready to make castings. Generally, the first few castings reveal the necessity for minor adjustments such as supplying additional vents, increasing the riser size, enlarging gates, etc.

Conclusion

Many foundries have not accepted the permanent-mold method of casting aluminum; other foundries probably were not entirely satisfied with their first experience. Also, many qualified establishments have not attempted to make a permanent mold, and the experiments of others have resulted in failure. If the requisite talents, skills, equipment, facilities, and experience are available, the results obtained from a properly constructed permanent mold will be gratifying to moldmakers as well as to casting buyers.

CONVENTION TECHNICAL PAPERS To Reflect Developments of Entire Field

IN THE MORE THAN 50 technical papers scheduled for presentation at the 51st Annual Meeting of the Association, April 28–May 1 in Detroit, A.F.A. will offer comprehensive, informative discussions of foundry techniques and problems of vital interest to every segment of the castings industry.

Review of the technical papers approved by division Program and Papers committees reveals the broad scope of the searching analysis that will be conducted by foundry technologists into the methods, practices and processes of their field. Theoretical studies and their conclusions will be detailed; practical recommendations on everyday problems of every type of foundry will be made.

On the program for thoroughgoing discussion will be melting, alloying and pouring practices; inspection and finishing methods; testing procedures; patternmaking; coremaking; molding, and many other of the facilities and techniques involved in the production of better castings.

Steel foundrymen will hear, among the many outstanding technical papers, one on "Occurrence of Intergranular Fracture in Cast Steel." Another paper will be concerned with the determination of temperatures of molten steel. Also scheduled is a description of some effects of melting practices on the properties of low alloy cast steel.

Those of the foundry who must accept or reject the finished product can anticipate, at one of the inspection sessions, an analysis of the role of magnetic particle inspection. Operation of the method and a number of variables affecting its sensitivity will be covered, as will its use as a production aid in determining proper size, number and location of risers, proper pouring temperatures, etc. The "Importance of Radiography to Inspection" will be another inspection session topic.

Gray Iron Division plans indicate technical sessions devoted to the many important factors in the casting of that metal. From the structure of pig iron to microradiography of the casting, the papers under consideration are expected to offer graphic portrayals of the newer techniques in the field. Studies of cupola practices, isothermal transformations, the role of minor constituents resulting from additions, and welding of the metal, are in prospect.

For malleable foundrymen there will be "An Interpretation of the Constitution of Iron-Carbon-Silicon Alloys"; a discussion of malleable iron finishing, and a study of the effects of section size and annealing temperature on graphitization of white iron.

A Convention highlight of the Brass and Bronze Division program will be the annual round table, which is expected to develop, this year, as in other years, an interesting, informal exchange of experiences and recommendations. "Radiography of Gun Metal Castings" will be studied.

At a cost accounting session, "Two Ways to Make a Profit," namely, "by sheer force and . . . by the use of planned techniques," will be delineated. That paper, a case history of a plant where outmoded controls were replaced with others that made "studied use of all available tools and techniques of shop and office," will undertake to demonstrate that "the odds greatly favor those who plan their objectives."

The Aluminum and Magnesium Division is considering presentation of an analysis of aluminum casting alloys, and a paper on the influence of inclusions on properties of sand castings. Also under consideration are discussions of feeding problems and blows.

"Preparation of Foundry Sands for Market" is to be the topic of one sand session. Typical deposits of sand suitable for the foundry; methods of mapping and prospecting before development, as a basis for planning a flexible mining and processing program; and the importance of processing, field supervision and laboratory control, will be covered.

The theme of the two sessions sponsored by the new Educational Division will be "Management's Stake in Personnel Training." Papers will reflect the vital interest of the industry in the encouragement of apprentice training and in a full presentation of the advantages of foundry careers.

Preprinting and distribution, well in advance of the Convention, of these and many other papers of equal timeliness, is expected to stimulate unusual audience participation in the divisional and general interest meetings and to encourage immediate presentation of the studied viewpoints of all segments of the castings industry.

Future Conventions and Exhibits

Feb. 18-20—Magnesium Exhibit, sponsored by the Army Air Forces, Wright Field, Ohio and the Magnesium Association.

Feb. 24-25 — Industrial Furnace Manufacturers Assn., Chicago.

Feb. 24-28—American Society for Testing Materials, Spring Meeting, Philadelphia.

March 6-8—National Association of Foremen, Cleveland.

March 6-8—Third Annual Educational Directors Conference, Hotel Carter, Cleveland.

March 17—American Institute of Mining and Metallurgical Engineers, New York.

March 17-19 — Chicago Production Show & Conference, Chicago.

March 17-19—American Society of Lubrication Engineers, Annual Meeting, Pittsburgh.

March 19-22—American Society of Tool Engineers, Rice Hotel, Houston, Texas.

March 22—American Welding Society, Pacific Coast District Meeting, Oakland, Calif.

March 22-27—Western Metals Congress & Exposition, American Society for Metals, Oakland, Calif.

April 14-18—111th National Meeting, American Chemical Society, Atlantic City, N.J.

*April 28-May 1—*AMERICAN FOUNDRYMEN'S ASSOCIATION, *51st Annual Meeting, Detroit.*

May 15-17—Society for Experimental Stress Analysis, Chicago.

Regional Conferences

Feb. 20-21 — Birmingham District Chapter, Tutwiler Hotel, Birmingham, Ala.

Feb. 28-March 1—Canadian Regional Foundry Conference, Royal York Hotel, Montreal, Que.

March 28-29—7th New England Foundry Conference, New England Foundrymen's Association, Massachusetts Institute of Technology, Cambridge, Mass.

CLEANING ROOM PRACTICE

Milton P. Schemel

The Symington-Gould Co.
Depew, N. Y.

Casting cleaning operations not properly performed are reflected in final inspection. Faulty work must be corrected at this point, with a consequent increase in cost. This added expense could be avoided if the operators concerned and their supervisors would make certain that their particular operations were properly performed. Castings returned for re-operation create additional cost, retard production, and often are the cause of a loss instead of a profit.

METHODS OF CLEANING and finishing castings vary in every plant, and depend upon size and type of castings made. Practices set forth in this article are those followed in the plant with which the author is associated.

Of foremost importance is the necessity of clearing the castings through the finishing department with a minimum amount of backtracking; that is, arranging the operations through the plant so that it will not be necessary to return castings for further work but, rather, keep them in steady progress toward the selling rails. This sounds simple, but in reality it requires a great deal of supervision and inspection to see that each operation is properly executed.

As a general procedure, castings are sent through the finishing department in the following sequence of operations; flogging, burning, normalizing, sandblasting, chipping, welding, grinding, final chipping and, finally, placing on the selling rails. In some cases it is necessary to divert from this procedure, owing to different types of castings produced, but the order as listed is the normal procedure.

Contact With Foundry

It is also essential to get the castings through each run as quickly as possible. This provides an opportunity of observing how the castings are coming from the foundry. It is a practice at the author's plant to observe daily the preceding day's castings. If this were not done, one could possibly have a difficult situation on hand in the event that something went wrong in the foundry.

It need not be something extremely important to result in increased unit cost and lowered production. By keeping close contact with the foundry superintendent and quality men, trouble and money can be saved, and production can be maintained at a steady level. In this way it is possible to have at all times a good knowledge of the condition of the castings produced in the foundry.

Flogging, or cleaning, consists of removing all cores, sand and rods from each casting, and also of breaking gates and risers wherever practicable. Where gates and risers cannot be broken by the flogger with a sledge hammer, they are removed by burning with a torch.

Most of the castings in the author's plant are cleaned of sand and cores by rapping, on a rapping machine. This is an air-driven machine with a single piston. The casting is put in the machine, against a rapping box, in such a manner that the head of the rapper piston strikes the riser or some solid part of the casting, thereby knocking the sand and cores off and out of the casting.

Removing Gates and Risers

The casting is then placed on the floor and, if possible, the flogger knocks off the gates and risers with a sledge. Any fins or flashing that would interfere with shotblasting are also removed.

Gates or risers that cannot be broken by hand are removed by an acetylene torch. Different methods must be employed in the case of armor castings. They must be heated to a temperature of 300 F before burning to prevent development of cracks in the castings. This preheat is unnecessary with other types of castings.

Oxygen and acetylene are piped to all parts of the finishing department. Acetylene, with 10- to 15- lb pressure at the generator, and 100 lb of oxygen on the line are used. Each burner has a regulator on both acetylene and oxygen, in order that the pressure on each man's line may be controlled according to the size of torch and tip used for each particular job.

Standards for burning different thicknesses of steel undoubtedly are known to most foundrymen. It is at times necessary to deviate from these standards, as they are set up primarily for steel plate and do not allow for burned sand and scale. As general rule, therefore, a tip that is one size larger than specified, and approximately from 10 to 15 lb more oxygen, are used. This makes a clean cut in the event of burned sand and scale.

Clean Burning Important

On risers 5 in. or larger in size, a large 36-in. torch is used. For trimming and small risers, a smaller 20-in. torch is used. The importance of clean burning cannot be stressed too strongly, as it reflects on the grinding and welding cost to a great extent. After flogging and burning operations, the castings are ready for normalizing.

Normalizing. In the normalizing operation, smaller castings are loaded in special baskets and placed on cars or charging racks. Larger castings are loaded on racks or rails, depending upon the size and shape of the castings. The normalizing equipment in an older plant (Plant O) consists of one 4-car continuous annealer which discharges one car every 35 to 50 min, depending upon the size and weight of the castings, and two 2-car gas machinery batch-type furnaces. All of these furnaces are oil-fired and can be used for either normalizing or drawing. In other words, they can be used at either high or low temperatures.

Furnace Operation

In another plant (Plant D) are four 10x10-ft oil-fired furnaces for normalizing; also, three hardening furnaces. These furnaces are charged by gantry cranes, with fingers that slide under the load on the charging racks and between the pedestals in the furnaces. A quench tank is located in front of one of

the hardening furnaces so that the load can be taken out by the gantry crane, lowered into the quench tank, and then placed in a draw furnace for tempering.

Temperature Determination

Normalizing temperatures and time limits are determined by the metallurgical department according to analysis of the heats. In the case of high tensile and armor heats, it is necessary to keep the heats together while going through the heat treatments designated for each particular heat. In other grades of castings this is not so important, but it is advisable when possible. After normalizing, the castings are taken to the shotblast or tumbler.

Shotblasting. It is important that a good job of shotblasting be done so that defects will not be missed by the inspectors as the castings go through the various operations. Plant O is equipped with a continuous shotblast with four operators who blast from the outside. These men operate their blasting nozzles while looking through glass windows. Each man has a particular area to blast as the casting passes his station on an endless chain. The castings are put on the chain at one end and taken off in the next bay at the other end.

In addition, this plant has two combination shotblast rooms with a turntable on one side and a car on the other. Smaller castings can be placed on one side of the turntable by the helper while the blaster works on the other side.

Shotblast Mixture

In Plant D there are three turntable shotblasts and one car house. A mixture of No. 10 steel shot, No. 14 steel grit and coarse sand is used for blasting. This mixture does not agree with recommendations of the manufacturer, but it has been found to clean faster and, it is believed, better. The mixture also helps to eliminate static in the hose, even though the hose is nonstatic. It has been found that, especially on cold mornings, it is almost impossible to hold the hose unless sand is added to the mix.

On the continuous blast, No. 7 nozzles are used. They have a tungsten-carbide center with a 3/8-in. hole, and have a life of from 200 to 500 hr blasting time.

In the shotblast rooms the standard No. 6 nozzle is used. These nozzles are removed when they show 3/16-in. wear. On all the shotblasts, 100-lb air pressure is used and, as the nozzle wears, the amount of air and shot is increased. If the nozzle is allowed to become worn, it will empty the shot tank too quickly, and will cause the operator to stop too often. All of these items add up to the fact that it is less expensive to put on a new nozzle before the old one reaches the point of inefficiency.

The plant also employs a shotblast tumbler in which all small castings up to about 50 lb each are cleaned. From the shotblast, the castings generally are taken to the chipping bench.

Chipping. The human element is one of the main factors to be considered in the chipping operation. It is seldom that two chippers perform alike. Some chippers want their chisels sharpened one way and some another; some want slow, heavy-hitting hammers, while others want light, fast hammers.

Chipping Hammers

In order to overcome these differences each man has a chisel box in which he keeps his own chisels. All hammers are stamped with a number, and each hammer is assigned to a certain man. He also has his own hose, which is locked in a cupboard at the end of his turn. Each night the man returns his hammer and tool box to the tool room where the toolkeeper washes and oils the hammer.

Whalebone chisel blanks are forged in the blacksmith shop, to any desired shape. Each man sharpens his own chisels in the way he considers best for his style of chipping. When a chisel has been worn down or loses its temper it is returned to the toolroom in exchange for another. Worn-out chisels are returned to the blacksmith shop for reworking.

Most of the chippers prefer a No. 2 hammer, which is a good all-around tool, particularly in cutting thick and thin flashing on the same casting. Some of the rough chippers prefer pneumatic chipping hammers. These hammers are excellent for cutting heavy scrap. On the rough chipping bench all fins, nails and flashings are chipped off and all dirt spots chipped out. One test coupon is broken from the casting to check tensile properties, following heat treatment.

It is important that good inspection be made here, since anything that the inspector misses at this point must receive attention when the casting is on the final bench, which slows production and adds to the cost of the job.

Preparation for Welding

Welding. The most important operation in welding is to prepare the casting properly. It is essential that the defect to be repaired be entirely cleaned, either by chipping or by acetylene torch. A washout tip when properly used leaves a clean groove that is practically free from scale and ready for welding. Several makes of 500-ampere welding machines are employed.

The electrodes are 5/16-in., 3/16-in., and 1/4-in., respectively, each used according to size and position of the welds. For general-purpose welding, an AWS E6010 welding rod is adequate; on armor, the welding rod specified by Army Ordnance or Navy Specification is used. A considerable amount of oxyacetylene welding is done on some types of castings. Both types of welding are good for different classes of work.

Grinding. After welding, the castings are taken to the grinders (Table 1). In this operation all partings, risers, gates and defects that have been welded or burned are ground. Several types of grinders are used; namely, swing-frame grinders for larger castings, stand grinders for smaller castings, and hand grinders that are used to reach places not accessible to the swing or stand grinders.

Grinding Wheels

As a matter of safety, each man is required to get his own grinding wheels from the storeroom. The reason for this is that he knows he is going to use those particular wheels and, therefore, is careful in handling them. Should he happen to drop or hit a wheel in some manner he so informs his foreman and the wheel is retested before it

Table 1
GRINDING WHEEL DATA

Maker's Designation	*Size of Wheel, in.*	*Use or Remarks*
5-14Q-14B 14-14-8 141-PL 163-10-K7	20x2½x10	For snagging with swing-frame grinders.
14-13-7 141-PK	24x3x12	For snagging with swing-frame grinders and 24-in. stand grinders; except for knuckles.
BLX-1056x14x2P	30x2x12	For stand grinders in grinding knuckles. When these wheels wear down to 24 in. they are then used for snagging small castings on stand grinders.
10 U C109-S-5	Vitrified 18x2x1¾ Tapered ¾-in. per ft.	Swing-frame grinders for couplers; slow-speed machines.
163-12 -K7 57A-123-N6B5	36x3x12	For grinding wedges on stand grinders. These wheels are worn down to 30 in. by polish grinding the wedges, transferred to another machine for rough grinding the wedges and other castings. When worn down to 24 in. the stub is mounted on a swing-frame machine for snagging housings.
12-0-14B 12-PB-E5	12x2x1¼	For internal grinding with home-made machine.
16-R	2x3x⅝	For internal grinding hole in coupler shanks.
203-9-K4 20 Q-14B 16-Q4T-H 203-HC 3	8x1x⅝	For grinding welds to close tolerances by portable hand grinders.
203-9-K4 16 Q 5716R-4T-H	4½x2x⅝ cup wheels	For grinding to gage with air-driven angle grinders.

is mounted on the grinder for use.

Keeping a close tab on emery wheel costs is a paying proposition. A great deal of money can be ground away if the wheel is too soft; and man hours can be built up and production slowed down if the wheel is too hard.

Grinding Records

All of the castings ground on each wheel on each machine are recorded. Each machine is numbered, and each day the number of pieces ground on each machine are recorded on the man's card. In this way he knows which types of wheels are giving the best performance and cost. Three types of hand grinders and six types of wheels are available to take care of the various jobs produced in the plant.

Final Chipping. Here one finds to what extent the foremen and inspectors have been on the job. All of the castings are thoroughly checked for defects, and for dimensional tolerances. Welds that could not be reached with the swing grinder are ground. If each operation has been properly executed, the castings that do not have to be pressed are ready to take to the scale, or to the selling rails in the event that the order calls for export and foreign inspection.

If the flogger left in some rods or the sandblast did not clean out some corners, or the rough chippers slipped some castings by the inspector without using the gages, or the welder made a poor weld and it has to be removed and rewelded, or if the grinder ground too much or too little, then one really has a job on his hands. These things seem unimportant individually but, considered collectively, they all must be corrected and the production yield lowers while the cost rises.

Casting Tolerances

Pressing and Straightening. As casting tolerances become closer, pressing and straightening become more important. Some of the smaller castings can be straightened by hand, but the larger ones must be straightened in the press.

Five large presses, ranging in capacity from 500 to 750 tons, and three small presses, one of 200- and two of 100-ton capacity, are available. It is necessary to have an operator and a helper when working with the larger presses; but with the smaller presses where the lighter castings are handled the operator works alone.

Much time and trouble can be saved if the castings are properly loaded on the annealing cars, and if the foundry does not shake-out while the castings are too hot. With some castings it has been found necessary to establish a minimum time after pouring and before shaking out. With other castings, great care must be taken in loading for normalizing and heat treating to eliminate distortion. Some castings, too large for the presses, are loaded on annealing cars and straightened by careful shaking or vibration and bringing them to the annealing temperature.

Special Equipment

For many of the production castings it is necessary to build special dies and rigging to be used in pressing. On long-run jobs this equipment pays for itself many times over. Each press is equipped with blocks, rollers, and press pins of various lengths and sizes, to take care of miscellaneous work. It is necessary to have at least two each of the blocks, rollers, and press pins at each press. After the castings are pressed or straightened the inspectors examine them and, if satisfactory, pass them for either foreign or domestic shipment.

NEW ENGLAND CONFERENCE
Will meet at Massachusetts Institute

AN OPEN DISCUSSION, among foundrymen, metallurgists and engineers, of problems encountered in the design and manufacture of castings, is the objective of the Seventh New England Foundry Conference, sponsored by the New England Foundrymen's Association and scheduled for March 28-29 at Massachusetts Institute of Technology, Cambridge, according to M. A. Hosmer, Hunt-Spiller Mfg. Corp., Boston, chairman, conference arrangements committee.

Sessions of Friday, March 28, will be of special interest to management and technical men, Mr. Hosmer said, while those of Saturday will be designed particularly for the foundrymen.

A.F.A. National Director H. H. Judson, Standard Foundry Co., Worcester, Mass., is a member of the conference arrangements committee. D. L. Parker, General Electric Co., West Lynn, Mass., serves as vice-chairman of that group, which also includes D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn., and Chairman, A.F.A. Sand Shop Operation Course Committee, member of the Executive Committee of the Association's new Sand Division; and Howard Taylor, associate professor, M.I.T., and member, Executive and Program and Papers committees, A.F.A. Sand Division.

Other members of the planning body are: Charles Bailey, Patch-Wagner Co., Rutland, Vt.; A. F. Dockry, H & B American Machine Co., Pawtucket, R. I.; Frank Elliot, Westinghouse Electric Mfg. Co., Springfield, Mass.; John Erler, Farrel-Birmingham Co., Ansonia, Conn.; F. M. Fitzgerald, Draper Corp., Hopedale, Mass.; Henry Griggs, Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.; W. B. Hagerman, Rice, Barton Corp., Worcester; Raymond Meader, Whitin Machine Works, Whitinsville, Mass.; C. F. Merrill, Draper Corp.; D. A. Nemser, International Nickel Co., Hartford, Conn.; R. H. Rehm, Cranston, R. I.; Dr. W. M. Saunders, Providence, R. I.; L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence; J. B. Stazinski, General Electric Co., Lynn; L. C. Tarantino, Niagara Falls Smelting & Refining Co., New Haven, Conn.; R. C. Walker, Whitin Machine Works; A. S. Wright, Hunt-Spiller, and Albert Ziegra, Fay & Scott.

Massachusetts Institute of Technology, Cambridge, site for the 7th New England Foundry Conference.

SEVENTH NEW ENGLAND FOUNDRY CONFERENCE
New England Foundrymen's Association
Massachusetts Institute of Technology, Cambridge
March 28-29

(Tentative Program)

Friday, March 28

9:00 am—Registration
9:30 am—Opening Session
CHAIRMAN, D. L. Parker, General Electric Co.
Address of Welcome
9:45 am—Technical Session
CHAIRMAN, L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I.
Mechanization and Modernization in the Foundry; and *Pattern Equipment.*
12:15 pm—Luncheon
2:00 pm—Technical Session
CHAIRMAN, Dr. W. M. Saunders, Providence, R. I.
Synthetic Core Binders; Welding Cast Iron; and *Steel Discussion.*
6:00 pm—Conference Dinner
CHAIRMAN, M. A. Hosmer, Hunt-Spiller Mfg. Corp., Boston.

Saturday, March 29

9:00 am—Registration
9:30 am—Technical Session
CHAIRMAN, A. S. Wright, Hunt-Spiller Mfg. Corp.
Cupola Practice; and *Foundry Sands.*
12:00 noon—Luncheon
2:00 pm—Technical Session
CHAIRMAN, Raymond Meader, Whitin Machine Works, Whitinsville, Mass.
Non-Ferrous Round Table; and *Casting Defects, Their Causes and Remedies.*
5:00 pm—Adjournment

Considerable concern is felt in the foundry industry at the present time because of the lack of interest among intelligent and competent young men in foundry careers. An analysis of the situation has been undertaken by some educators and foundry managements in an attempt to discover the underlying difficulties. This is proving effective in that qualified students are being advised of the opportunities offered by the foundry, and a source of skilled workers and supervisors provided for the industry.

INDUSTRIAL FOUNDRY PROGRAM

TECHNICAL HIGH SCHOOL

George Davis
Foundry Instructor
Crane Technical High School
Chicago

Technical high school student testing sand specimens in sand laboratory of the cooperating foundry.

PLANS have been formulated in the past to induce competent young people to seek a career in the castings industry. This problem is an old one which far-sighted men have seen coming, but which, except in a few isolated cases, they have done little to forestall. Had their planning been more concrete and their follow-up more sustained, the situation at the present time might be less alarming.

Not enough has been done to interest competent, able young men in the industry, although recently the American Foundrymen's Association has inaugurated an effective educational program. It is essential that more and continued emphasis be placed on securing better boys for the castings industry—on teaching that a foundry is a good place in which to work.

Once a boy has elected to follow the foundry industry he should be encouraged and interest shown in his advancement. Educators and

foundrymen should reveal to these boys the unlimited possibilities which the cast metal industry offers for a career, for advancement, for scientific research and discovery in chemistry and metallurgy.

Foundrymen know that there is no industry requiring comparable intelligence, resourcefulness and dependability which gives a better return in satisfaction for a job well done and in money. But these facts are not widely known and more should be done to advertise them. Even in schools, poorly informed teachers and student advisors believe that the foundry and other shops are the last recourse when dealing with problem students.

Industry Representatives

For many years, representatives of almost every phase of industry and the professions have given talks before vocational guidance classes. These men have been able to induce students of high caliber to enter the various fields represented by the speakers. However, this has seldom been done by foundry representatives. This seems particularly unfortunate because young men who are considering their life work should be apprised of working conditions, wages and promotional possibilities in the castings industry as well as in other fields.

The average youth has little understanding of the jobs and opportunities in the foundry. He is beguiled by those who find glamor only in a white collar and who lead him to believe that over-alls are a badge of dishonor. This is a gross injustice to the over-alled men and to the boy as well, since he is being deprived of the satisfaction and sense of security which come with the knowledge that one is well trained to do a useful type of work.

An education in its truest sense can be obtained from the learning involved in a foundry career. In addition, few live more comfortable, happy, and serviceable lives than the men who have become skilled in foundry work.

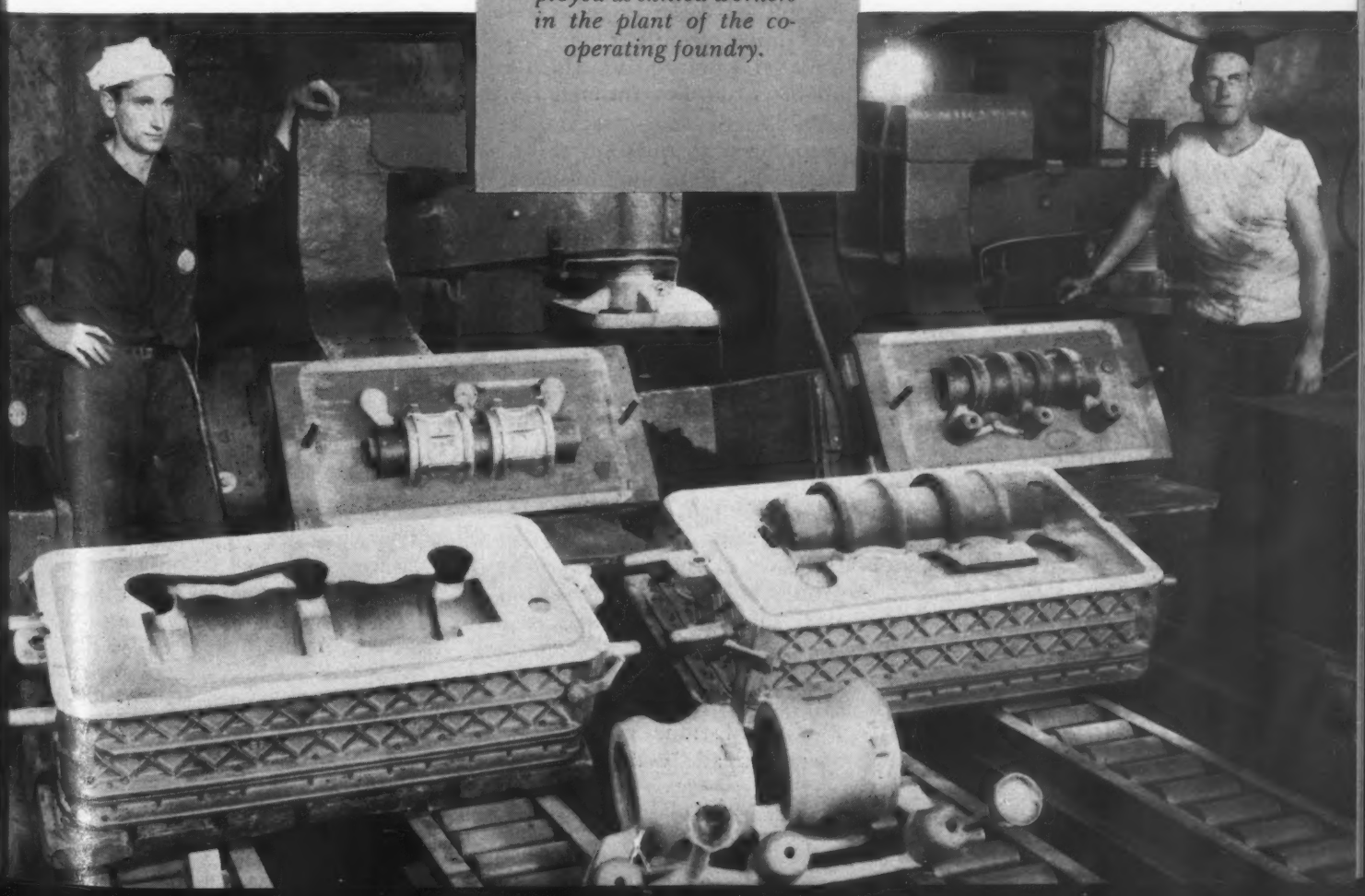
The world of tomorrow is being shaped in the classrooms of today. This is the time, then, for the leaders of the castings industry to look to the public schools for the workmen who will be needed in the years to come. These leaders should use their influence and cooperate to better the training which the schools have been striving to give. Organized efforts on the part of the industry and the schools to provide an enriched program will prove well worthwhile.

Planned Foundry Tours

Cooperative programs should include planned series of tours to local foundries, starting when the student is in the eighth grade and carried on through high school. Representatives of the castings industry with suitable motion pictures should visit the schools.

Machinery and laboratory equipment might well be donated or loaned to certain schools by companies interested in securing more competent employees. Thus far, the castings industry has not scratched the surface in cooperative efforts with classroom instructors, and instructors themselves have shown too little enterprise in making contacts with the industry.

One cooperative experiment has been carried on at Crane Technical High School in Chicago with gratifying results. During the past 5



Technical high school graduates regularly employed as skilled workers in the plant of the cooperating foundry.

Students receiving instruction in risering and gating practice during regularly assigned visit to the plant of the cooperating foundry.

years, this school has had the cooperation of the Burnside Steel Foundry Co., Chicago, in the furtherance of the education of the school's young foundrymen. Through the courtesy of this company, boys visit the plant and spend a number of full days studying actual production activities.

In addition, the company has given the school equipment such as sand testing apparatus, tensile strength and Brinell testing machines, and flask equipment. The company has also sent the school obsolete patterns and core boxes for molding and coremaking.

Equipment Supplied

When this plan was established, the objective was to provide a system of training superior to that offered by the average vocational school. The cooperative experiment has indicated that students can be started well on the path toward foundry skill and kept on that path while in school. By the time they enter industry, the students have mastered the most important fundamentals and are better prepared for the more advanced training. These boys will solve the skilled-worker and supervisory problem in the years to come.

The plan of cooperation is as follows: On a given date, three young men of the class report at the plant instead of at school. They are met at the gate by the instructor, who has been assigned to them by the company for that particular day. If the school has given them an assignment in sand control, they are taken to the sand control laboratory where they operate the equipment and gather data relative to sand control and sand mixtures. Part of the day is spent at the mullers, observing sand mixing and distribution to the numerous molding units on the floor.

Before leaving the school each student has been given a booklet containing carefully planned questions. If a point arises which he is unable to answer through his observation of an operation, he is encouraged to question the plant instructor. Returning to school on the following day, he is asked for a complete review of his trip. Class discussions are held and explanations made by the teacher. Members of the class who go to the foundry at a later date profit by this system of procedure.

On other days, different groups from the class report to the plant for a similar study. This continues until every member of the class has had training in sand control. Then the teaching cycle begins anew, members of the class reporting in groups of three for instructions in such subjects as molding production methods, cleaning room methods, electric furnace operations, gating and risering. In the student's 2 years of trade preparation, he spends in all 16 days of 6 hours each studying and practicing commercial foundry methods.

High school students learn a great deal through observation, application and practice on these training trips. Moreover, they witness on a large scale the results of cooperation among workers, a principle which is instilled in the students during their classroom work at school. The students are impressed with the idea that the foundry is a good place in which to work, and that the opportunities in it equal or excel those in many other branches of industry.

The management of the cooperating company feels that the results of this experiment fully justify the efforts the company has made to develop craftsmanship in the boys. The plan is a concrete demonstration of how young people of high school age, sympathetically guided by those who are foundry-minded, can be encouraged to enter the castings industry. There the former students give satisfaction and a feeling of pride to those who have been instrumental in acquainting them with the opportunities to be found in the foundry.

A.F.A. Reprints Code

FUNDAMENTALS OF DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE OF EXHAUST SYSTEMS, A.F.A. Code No. 3, has been reprinted by the Association to satisfy the continuing heavy demand for basic exhaust information. Engineers, maintenance crews and foundry operators find in the code usable techniques for removing dust, dirt, gases and mists, to protect the health of workers and to foster safe industrial housekeeping practices.

The fundamentals of exhaust systems apply to the foundry and its subdivisions—cleaning room, pattern, machine and maintenance shops. Code No. 3 provides the necessary engineering data for exhaust systems in gray iron, malleable, steel and non-ferrous foundries.

151 pages, 35 illustrations, imitation leather and ring binder. Price, to A.F.A. members, $3.00; to nonmembers, $4.00. Copies may be obtained from A.F.A., 222 West Adams St., Chicago 6.

★ NEW A. F. A. MEMBERS ★

December 15, 1946, to January 15, 1947— With Chicago compiling 15 new names and Philadelphia, Northern Illinois-Southern Wisconsin, Canton, Western Michigan and Washington netting 7 apiece, the below list contains a total of 130 new members and three conversions. Twenty-eight Association groups reported an increase in their membership strength and these new men are being, or have been, warmly received.

Conversion—Company to Sustaining

**Minneapolis Moline Power Implement Co., Minneapolis, Minn. (Herbert Larson, Fdry. Supt.)

Conversions—Personal to Company

*Brisk Foundry & Machine Co., Imlay City, Mich. (Chas. Schneider, Supt.)

*Sweets Foundry, Inc., Johnson City, N. Y. (Milton H. Steele, Partner)

BIRMINGHAM DISTRICT CHAPTER

Herbert A. Newbury, Box 477, Birmingham, Ala.

CANTON DISTRICT CHAPTER

Albert Barker, Fore., The Machined Steel Casting Co., Alliance, Ohio.
John W. Boyle, Fore., The Machined Steel Casting Co., Alliance, Ohio.
Louis A. Brenet, The Machined Steel Casting Co., Alliance, Ohio.
James Burtnett, Fore., The Machined Steel Casting Co., Alliance, Ohio.
Harold L. Hoiles, Core Fore., The Machined Steel Casting Co., Alliance, Ohio.
Kenneth Knoch, Fore., The Machined Steel Casting Co., Alliance, Ohio.
William M. McNely, Fore., The Machined Steel Casting Co., Alliance, Ohio.

CENTRAL INDIANA CHAPTER

Wayne Bodge, Fdry. Supt., Frank Foundries Corp., Muncie.
Raymond Hale, Fore., The Perfect Circle Co., New Castle.
Fred E. Parsons, Fore., National Malleable & Steel Castings Co., Indianapolis.
Merle E. Schultz, Asst. Plant Mgr., Frank Foundries Corp., Muncie.
Huston G. Welch, Student, Allison Div., General Motors Corp., Indianapolis.

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Ralph E. Bates, Fdry. Supt., U. S. Radiator Corp., Geneva.
Wendell F. Erwin, Fore. Pttn. Shop, Sweets Foundry, Inc., Johnson City.
I. Niles Kitchen, Asst. Supt., Sweets Foundry, Inc., Johnson City.
Wm. H. McCreary, Vice Pres., Sweets Foundry, Inc., Johnson City.

CENTRAL OHIO CHAPTER

George W. Altman, Engr., Furnace Foundry Co., Jackson.
George H. Tulk, Supt., Furnace Foundry Co., Jackson.

CHESAPEAKE CHAPTER

David A. Myers, Melting & Annealing Fore., American Chain & Cable Co., Inc., York, Pa.
George W. Nickol, Pattern Shop Fore., American Chain & Cable Co., Inc., York, Pa.
James A. Rowland, Met., Norfolk Naval Shipyard, Portsmouth, Va.
Ernest S. Whiteleather, Molding Fore., American Chain & Cable Co., Inc., York, Pa.

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Jack Caldwell, Met., Apex Smelting Co., Chicago.
Otto J. Cech, Elesco Smelting Corp., Chicago.
James L. Crawford, Jr., Engr., Lester B. Knight & Associates, Chicago.
Conrad O. Hense, Fore. Metal Dept., Howard Foundry Co., Chicago.
Cornelius A. Johnson, Metallographer, Armour Research Foundation, Chicago.
Thomas Johnston, Model Shop Fore., Howard Foundry Co., Chicago.
Charles A. Krause, Sand Tech., Howard Foundry Co., Chicago.
B. M. Loewenstein, Salesmanager, Howard Foundry Co., Chicago.
Harold V. May, Draftsman, Lester B. Knight & Associates, Chicago.
G. W. Merrifield, Lester B. Knight & Associates, Chicago.
Andrew Nelson, Supt., Howard Foundry Co., Chicago.
John H. Romann, Vice-Pres., U. S. Engineering & Mfg. Co., Chicago.
Kenny P. Smith, Fore., Chicago Malleable Castings Co., Chicago.
Louis A. Warzecha, Asst. Met., Howard Foundry Co., Chicago.

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Bruce R. Shue, Met., Dayton Malleable Iron Company, Dayton, Ohio.

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John J. Mark, Sls. Engr., E. J. Woodison Co., Detroit.
Franklin B. Rote, Asst. Prof, University of Michigan, Ann Arbor, Mich.

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** Sustaining Members

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James G. Dick, Met., Canadian Bronze Co., Ltd., Montreal, Que.
A. G. Lennon, Asst. Stds. Engr., Crane Ltd., Montreal, Que.

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Harry O. Williams, Owner, Williams Bros., New Britain, Conn.

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Clyde F. Resseguie, Jr., Schuyler Rose, Inc., Refractories Div., South Bend, Ind.

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Clayton O. Hange, The Ferro Machine & Foundry Co., Cleveland.
Harry E. Hillstrom, Met., Aluminum Co. of America, Cleveland.

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Myron D. Soares, Pacific Steel Casting Co., Berkeley.

NO. ILLINOIS-SO. WISCONSIN CHAPTER

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John G. French, Repr., Elesco Smelting Corp., Rockford, Ill.
Jerry Groters, Gen. Fore., Gunite Foundries Corp., Rockford, Ill.
William C. Kremer, Repr., Werner G. Smith Co., Chicago.
Chester H. Rudoll, Yard Supv., Gunite Foundries Corp., Rockford, Ill.
Nick Segalla, Melt. Fore., Gunite Foundries Corp., Rockford, Ill.
Howard Slusser, Supt., Gunite Foundries Corp., Rockford, Ill.

ONTARIO CHAPTER

*Canadian Brass Co., Ltd., Galt. (C. E. Fuller)
M. A. Phelan, Dist. Mgr., Canadian Refractories, Ltd., Hamilton.
Joseph Runciman, Fdry. Fore., Canadian Brass Co., Ltd., Galt.

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Michael Bowes, Gen. Fore., The Baldwin Locomotive Works, Philadelphia.
Albert Comeau, Supt., Modern Brass Foundry Co., Philadelphia.
LeRoy Culleney, Gen. Fore., The Baldwin Locomotive Works, Philadelphia.
Joseph Hager, Sr., Asst. Supt. of Fdries., The Baldwin Locomotive Works, Philadelphia.
Fred Johnson, Gen. Fore., The Baldwin Locomotive Works, Philadelphia.
Arthur Van Newkirk, Salesman, Metal Reduction Corp., North Bergen, N.J.

QUAD CITY CHAPTER

Wayne J. Burke, Sales & Advertising Dept., Davenport Machine & Foundry Co., Davenport, Iowa.
L. W. Follett, Chief Engr., Davenport Machine & Foundry Co., Davenport, Iowa.

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Merle Schuster, Sales Engr., E. J. Woodison Co., Detroit.

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Ben H. Cox, Fdry. Fore., Fulton Iron Works, St. Louis.
James R. Crain, Sand Tech., American Brake Shoe Co., St. Louis.
Edmond L. Fields, Chief Engr., H. W. Clark Co., Mattoon, Ill.
Francis P. Holland, Cost Engr., Century Foundry, St. Louis.

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David E. Neustadt, Sales Engr., American Wheelabrator & Equip. Corp., Mishawaka, Ind.
Nelson G. Phelps, Dist. Repr., Ironton Fire Brick Co., Los Angeles.

TEXAS CHAPTER

Wm. Clarkson III, Asst. Plant Mgr., Oil City Iron Works, Corsicana.
T. F. Jones, Foreman Cleaning Rm., East Texas Electric Steel Co., Longview.
Odes Laminack, Fdry. Fore., East Texas Electric Steel Co., Longview.
L. P. Lee, Prod. Mgr., East Texas Electric Steel Co., Longview.
Tommy N. Nettles, Fdry. Insp., East Texas Electric Steel Co., Longview.
Chas. H. Winterborne, Mgr., W. H. Winterborne & Sons, San Antonio.

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Fred Kvmor, Vice-Pres., Toledo Matchplate Co., Toledo, Ohio.
N. T. McClellan, Purch. Agent., Hillsdale Foundry Co., Inc., Hillsdale, Mich.
A. V. Schmucker, Production Mgr., Hillsdale Foundry Co., Inc., Hillsdale, Mich.

TWIN CITY CHAPTER

Harold E. Cartier, Met. Engr., Twin City Testing & Engineering Laboratory, St. Paul.
Ben J. Grimm, Chemist Partner, Twin City Testing & Engineering Laboratory, St. Paul.
**Minneapolis-Moline Power Implement Co., Hopkins, Minn. (L. W. Williamson, Supt.)
Peter Valois, Fore., Flour City Ornamental Iron Co., Minneapolis.

WASHINGTON CHAPTER

Charles M. Anderson, Vice-Pres., Eagle Brass Foundry Co., Seattle.
Paul H. Jackson, Mgr., American Smelting & Refining Co., Seattle.
Robert B. Knight, Steel Foundry Fore., Sumner Iron Works, Everett.
Ervin E. Miller, Fdry. Fore., Coolidge Propellor Co., Seattle.
*Pacific Car & Foundry Co., Renton. (O. A. Tucker, V.P. Charge of Operations)
O. V. Reardon, Salesman, American Smelting & Refining Co., Seattle.
Russell Wetherell, Purch. Agent, Olympic Foundry Co., Seattle .

WESTERN MICHIGAN CHAPTER

Clifford Franklin, Campbell Wyant & Cannon Co., Muskegon Heights.
Oswald C. Hansen, Plt. Engr., Muskegon Piston Ring Co., Sparta.
Gerald Leach, Fore., Muskegon Piston Ring Co., Sparta.
C. H. Lloyd, Engr., E. F. Houghton & Co., Philadelphia
Clinton Lundquist, Fore., Muskegon Piston Ring Co, Sparta.
Karl G. Sundquist, Partner, Holland Pattern Co., Holland.
Gerrit Witt, Partner, Holland Pattern Co., Holland.

* Company Members
** Sustaining Members

WESTERN NEW YORK CHAPTER

Dean A. Harrington, Asst. Sales Mgr., Frontier Bronze Corp., Niagara Falls.
Robert F. Oaks, Sales Engr., Electro Refractories Alloys Corp., Buffalo.

WISCONSIN CHAPTER

*Diamond Foundry Co., Waukesha. (Herbert Wagner, Pres.)
P. F. Laufenberg, V.P., Diamond Foundry Co., Waukesha.
Robert Fred Speerbrecher, Molder, Allis Chalmers Mfg. Co., West Allis.
Dan A. Srnec, Secy-Treas., Diamond Foundry Co., Waukesha.

OUTSIDE OF CHAPTER

Lauren R. Reynolds, Jr., General Wesco Stove Co., Springfield, Mo.

Argentina

Jose M. Moreno Bunge, Engr., Santos Vega S.R.L., Buenos Aires.

Brazil

Ambrosio D. Sala, Engr., Sociedade Tecnica de Fundicoes Gerais S.A., Sao Paulo.
**Sociedade Tecnica de Fundicoes Gerais S.A., Sao Paulo.

China

Central Shipbuilding Corp., Shanghai.

England

Joseph Walter Dews, Chief Met., John Harper & Co., Ltd., Willenhall Staffs.
S. E. Janson, Dr., Science Museum Library, London, S.W. 7.
William Copeman Newell, Dr., The British Iron & Steel Research Assn., London, W. 1.

France

Centre de Documentation, Centre National de La Recherche, Paris.
Robert Dureuil, Mgr. Foundry, 4, Square du Graisivaudan, Paris 17.

Scotland

Thomas R. Goodwin, Works Chemist & Met., Smith, Wellstood Ltd., Stirungshire.

1947 CONVENTION DIVISION SCHEDULES

(Tentative)

Aluminum and Magnesium

Business Meeting, April 28, 8:00 pm. *Technical sessions:* April 28, 10:00 am, 4:00 pm; April 29, 10:00 am. *Round Table Luncheon,* April 29, 12:00 noon.

Brass and Bronze

Business Meeting, April 30, 8:00 pm. *Technical sessions:* April 29, 10:00 am, 2:00 pm; *Round Table Luncheon,* April 30, 12:00 noon.

Educational

Business Meeting, April 28, 10:00 am. *Technical sessions:* April 28, 4:00 pm, 7:00 pm (Dinner and session).

Gray Iron

Business Meeting, May 1, 4:00 pm. *Technical sessions:* April 29, 2:00 pm; April 30, 10:00 am; May 1, 10:00 am, 2:00 pm. *Shop Course:* April 28, 4:00 pm; April 29, 8:00 pm; April 30, 8:00 pm; May 1, 2:00 pm.

Malleable

Business Meeting, April 29, 2:00 pm. *Technical sessions:* April 28, 10:00 am, 4:00 pm; April 29, 10:00 am. *Round Table Luncheon,* April 29, 12:00 noon.

Patternmaking

Business Meeting (and luncheon), April 29, 12:00 noon. *Technical session,* April 29, 4:00 pm. *Round Table Luncheon,* May 1, 12:00 noon.

Sand

Business Meeting, April 29, 4:00 pm. *Technical sessions:* April 29, 2:00 pm; April 30, 10:00 am. *Shop Course:* April 28, 8:00 pm (Malleable Iron); April 29, 8:00 pm (Non-Ferrous); April 30, 8:00 pm (Steel); May 1, 4:00 pm (Gray Iron).

Steel

Business Meeting, April 30, 8:00 pm. *Technical sessions:* April 30, 10:00 am; May 1, 10:00 am, 4:00 pm. *Round Table Luncheon,* May 1, 12:00 noon.

FOUNDRY PERSONALITIES

J. M. Price, president, Ferro Machine & Foundry Co., Cleveland, continues as president following purchase of the plant and equipment of that firm by a group of its officers and management personnel under his leadership, and its organization as Ferro Machine & Foundry, Inc. Other officers are: vice-president, **H. B. Myers;** vice-president and secretary, **R. H. Weir;** treasurer, **N. E. Gauthier,** and, assistant treasurer, **E. M. Knapp.**

W. I. Neimeyer, vice-president in charge of operations, National Bronze & Aluminum Foundry Co., Cleveland, has advanced to president of the firm, succeeding **D. W. Hornbeck,** recently resigned.

O. A. Pfaff, American Wheelabrator & Equipment Corp., Mishawaka, Ind., and President, Foundry Equipment Manufacturers Association, Cleveland, recently announced that association's committee personnel. Serving on the Executive Committee, with Mr. Pfaff, are: **W. L. Dean,** Mathews Conveyor Co., Ellwood City, Pa.; **Thomas Kaveny, Jr.,** Herman Pneumatic Machine Co., Pittsburgh; **H. S. Hersey,** C. O. Bartlett & Snow Co., Cleveland, and **P. J. Potter,** Pangborn Corp., Hagerstown, Md.

Chairman of the Public Relations Committee, is **B. L. Simpson,** National Engineering Co., Chicago, and an A.F.A. National Director; while **W. O. Vedder,** Pangborn Corp., and **M. I. Dorfan,** American Wheelabrator & Equipment Corp., serve as the association's delegates to the American Standards Association. President Pfaff and Mr. Kaveny, Jr. represent the Foundry Equipment Manufacturers Association on the National Castings Council which is now in its formative stage.

R. T. Stafford, since 1928 assistant manager, electrical department, in charge of the engineering and commercial activities of the Pittsburgh plant, Allis-Chalmers Manufacturing Co., was recently appointed assistant to the firm vice-president, **W. C. Johnson. J. W. McMullen** has been named general manager of the Pittsburgh plant, where he has been assistant manager of the transformer section since 1945; and **D. G. McArn** continues as works manager there.

R. T. Stafford **J. W. McMullen**

K. T. Fawcett **V. B. Browne**

V. B. Browne, associated for 38 years with Allegheny Ludlum Steel Corp., Pittsburgh, retired on January 1 as vice-president and technical director. He continues his affiliation with the organization as an honorary vice-president, and will be available for consultation. **F. B. Lounsberry,** vice-president in charge of methods and processes, succeeds Mr. Browne as technical director.

K. T. Fawcett has been appointed vice-president, Dominion Brake Shoe Co., Ltd., Canadian subsidiary of American Brake Shoe Co., New York. He joined American Brake Shoe Co. in 1934, in which year he graduated from Yale University, and has been assistant purchasing agent since 1944.

J. B. Rodgers and **W. A. Weld** have been elected vice-presidents of the Fensholt Co., Chicago.

E. C. Hummell, vice-president and general manager, Utility Electric Steel Foundry, Los Angeles, has been named a regional vice-president by the National Association of Manufacturers. Mr. Hummell is a member of A.F.A. with the Southern California chapter.

C. E. Williams, director, Battelle Memorial Institute, Columbus, Ohio, will be inducted as President, American Institute of Mining and Metallurgical Engineers, at the national meeting of that organization in New York on March 17.

Dr. L. C. Hicks was recently appointed assistant director of research, Allegheny Ludlum Steel Corp., Pittsburgh. He has been with the organization since 1933 and was associate director of research in charge of magnetic steel and allied products at the time of his promotion. In other appointments announced by the firm, **J. H. Crede,** a metallurgist with the research laboratory since 1935, succeeded Dr. Hicks as associate director; **C. H. Sheridan** advanced to associate director of research in charge of stainless steel and allied products, and **W. J. Baldwin,** of the company's research laboratory at the Watervliet, N.Y., plant, became chief plant metallurgist there, succeeding **R. P. DeVries,** retired.

B. H. Lehtonen, director, and **George Hellen,** plant manager, Rauta-Ja Metallivalimo, Helsinki, Finland, who are visiting foundries in the United States, were recent guests at the A.F.A. National Office, Mr. Lehtonen taking the opportunity to join the Association. Messrs. Lehtonen and Hellen were accompanied by **Charles Jensen,** representative in Finland for Sinclair Refining Co., with whom they are inspecting car wheel foundries and modern foundry equipment. The Finnish company produces both chilled iron and steel railroad car wheels.

H. E. Beane, associated with Bristol Co., Waterbury, Conn., since 1920 and appointed sales manager in 1943, has been promoted to general sales manager, according to a recent announcement by **H. H. Bristol,** company president.

R. U. Jackson, manager of the Charleston, W. Va., office for Robins Conveyors Div., Hewitt-Robins, Inc., became coordinator of mine conveyor sales for the firm, in a recent promotion. He is succeeded as manager of the West Virginia office by **J. W. Wantling,** who has an extensive background in coal mining and processing operations.

C. A. Bening will head the sales department of the new Bowes Coupling & Brass Div., United States Air Compressor Co., Cleveland, which will manufacture and market hose couplings and fittings, air valves and blow and spray guns.

Walter Horth, formerly foundry plant engineer, Cincinnati Milling Machine Co., Cincinnati, has joined National Engineering Co., Chicago as mechanical engineer. Mr. Horth, a graduate in mechanical engineering from the University of Berlin in 1928, was a designer of special machinery for German firms, prior to coming to

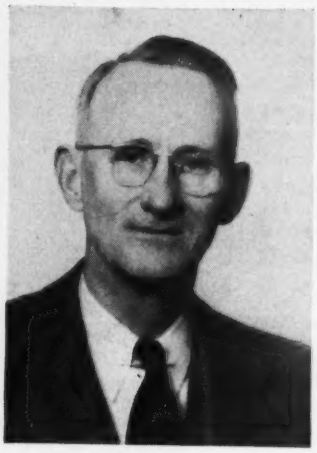
(Continued on Page 85)

Walter Horth **C. A. Bening**

CHAPTER OFFICERS

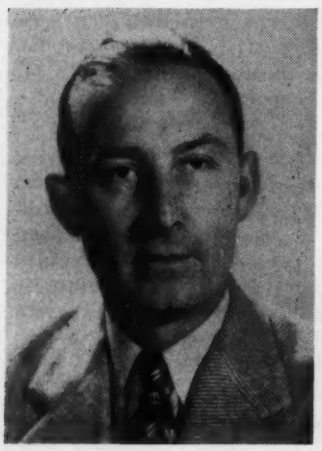
H. H. Lurie
Cummins Engine Co.
Columbus, Ind.
Director
Central Indiana Chapter

Harry L. Wren
Manufacturer's Representative
Houston, Texas
Secretary-Treasurer
Texas Chapter



Carl B. Johnson
Symington-Gould Corp.
Rochester
Director
Rochester Chapter

Fred K. Brown
Adams, Rowe & Norman, Inc.
Birmingham
Secretary-Treasurer
Birmingham District Chapter



Earl D. Shomaker
Kay-Brunner Steel Products, Inc.
Alhambra, Calif.
Treasurer
Southern California Chapter

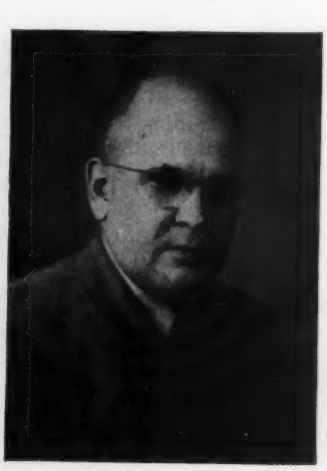
F. S. Brewster
Dow Chemical Co.
Bay City, Mich.
Secretary
Saginaw Valley Chapter

David Tamor
American Chain & Cable Co.
York, Pa.
Chairman
Chesapeake Chapter

R. D. Baysinger
Iron Star Foundry Co.
Rockford, Ill.
Director
N. Illinois & S. Wisconsin Chapter

R. W. Griswold, Jr.
124 W. 7th St.
Erie, Pa.
Director
Northwestern Pennsylvania Chapter

H. G. Robertson
American Steel Foundries
Alliance, Ohio
Director
Canton District Chapter



Floyd F. Ensign
Multi-Cast Corp.
Wauseon, Ohio
Director
Toledo Chapter

R. T. Leisk
American Steel Foundries
E. St. Louis, Ill.
Chairman
St. Louis District Chapter

FIRM FACTS

Plant and equipment of **Ferro Machine & Foundry Co.,** Cleveland, have been purchased by a group of officers and members of the management, under leadership of J. M. Price, president. Operations are now under the new firm name of **Ferro Machine & Foundry, Inc.**

Research facilities of **Peninsular Grinding Wheel Co.,** Detroit, have been greatly increased by additional building space and research equipment recently purchased. The new laboratory will have 2,000 square feet floor space.

Parkway Foundry & Machine Corp., Brooklyn, N. Y., has become a subsidiary of **Neptune Meter Co.,** Long Island City, N. Y., and continues under the same management, with the assistance of facilities of the Neptune firm.

The new **Tioga Foundry Corp.,** established by John Sweet and Arthur Cook at Owego, N. Y., has begun operation in the production of iron castings.

Clipper Mfg. Co. has expanded its facilities by construction of a new factory and general office building at **2800 Warwick, Kansas City, Mo.,** which includes a complete testing laboratory. The firm's St. Louis warehouse will be retained as a permanent shipping point for customers of that region.

Reduction of gas porosity in steel castings, through flushing with dry nitrogen or argon in a process developed by **Air Reduction Sales Co.,** New York, is clearly illustrated in photographs released by the firm. (See accompanying cut: Specimen at bottom shows porosity pockets; that at the top, the results obtained by flushing.) The only equipment necessary is a supply of the gas and a special tube through which it is introduced into the molten metal in the form of small bubbles.

Metal and wood patterns for the Birmingham, Ala., area, will be manufactured by a new firm, **Southern Precision Pattern Works,** which has built a new all-steel plant at 44th Street and 1st Avenue North, in that city. L. S. Moncrief, associated for 25 years with patternmaking at Stockham Pipe Fittings Co., Birmingham, is president of the new organization; and J. L. Corley and J. P. Bryant, both journeyman patternmakers of long experience, are vice-president and secretary-treasurer, respectively.

An industrial and public relations division, under direction of Phillip Lesly, has been established by **I. G. Grawoig & Associates,** First National Bank Bldg., Chicago, management consultants.

Midwest Foundry Supply Co., Webster Groves, Mo., has been dissolved, following the death of T. C. Hamlin, co-partner. W. A. Zeis, co-partner, has sold his interest in the firm and entered business under the firm name of **Walter A. Zeis,** in the same city.

Warren Alloy Industries, Warren, Mich., announces a change of firm name to **Royal Specialty Mfg. Co.,** and of address, to **20829 Mound Road, Van Dyke, Mich.** The organization is under the direction of Walter Kulchyski.

Production of plumbers' supplies is under way in a new iron foundry at Vincennes, Ind., **Murphy & Sons,** 2118 Chestnut Street, established by Francis Murphy. First orders were for fittings, with production of 4-in. soil pipe in 30-in. lengths scheduled for the immediate future, and activities expected to expand into special job work.

Ligonier Magnesium & Aluminum Foundry, Ligonier, Ind., has been purchased by Jerry Curto, F. C. Cygan and R. D. Payne, all formerly associated with **Acme Aluminum Foundry Co.,** Chicago. Operations will be under the firm name of **Curto-Ligonier Co.**

Automatic Transportation Co., Chicago, displayed the first of a new line of fork trucks, the "Automatic Sky Lift," at the National Materials Handling Exposition in Cleveland. The unit, which the firm designed after a survey among fork truck users, has a lift of 130 inches, standard 83-in. collapsed height, and other new features. Production on the line is scheduled for early this year.

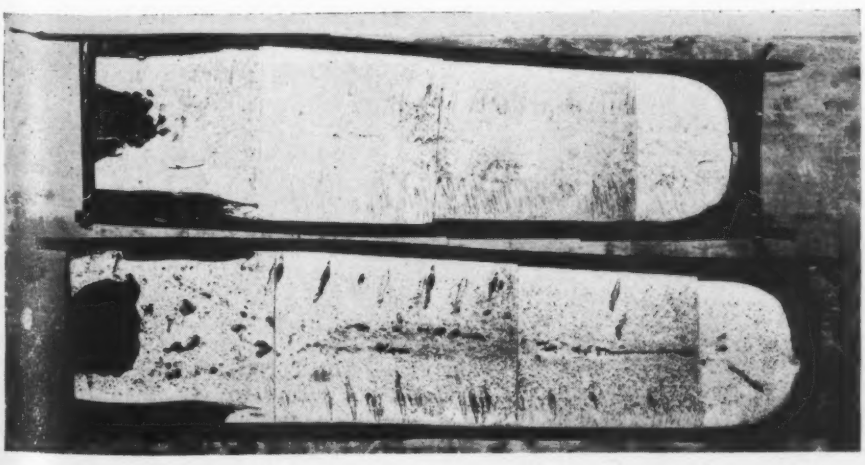
Kesler & Reynolds Foundry, Salem, Va., has begun operations in new quarters at 1201 Indiana Street, where a new plant has been constructed.

N. Ransohoff, Inc., Cincinnati, has undergone a change in ownership, with the purchase of controlling interest by John Straus, who will engage in the active management of the firm as vice-president and treasurer. Nathan Ransohoff, who will devote his activities to engineering and development, is president of the organization; and R. C. Wiggers serves as secretary and general manager.

Hydropress, Inc., New York, has opened a western office at 1065 Gas & Electric Building, Denver, Colo.

New quarters at 420 E. Ten Mile, Detroit, have been acquired by **United Foundries Co.,** according to the announcement of Duane Vincent, president of the firm and co-owner, with L. T. Tanner, of **Deluxe Pattern & Die Co.,** housed in the same building.

(Concluded on Page 82)



★ CHAPTER ACTIVITIES ★

news

STORK ALIGHTS ON ROCKIES
For Installation of 35th A.F.A. Chapter

NEWEST A.F.A. "baby," its Rocky Mountain Empire chapter, with headquarters at Denver, was formally installed January 14 at the Oxford Hotel there, with 75 enthusiastic foundrymen of the area participating in the ceremonies that marked the official entry of their group into the Association as its 35th chapter.

Rocky Mountain foundrymen took over the famous cast iron rattle which, less than a month previously, had been shaken over Seattle for the 34th "baby," the Washington A.F.A. chapter. (The stork was reported chuckling to itself and winging toward Tulsa.)

Acting Chairman J. L. Higson, Western Foundry Co., Denver, presided at the Denver installation and, after reviewing briefly the steps leading to formation of the chapter, introduced A.F.A. National Secretary-Treasurer W. W. Maloney. With the announcement that the petition for chapter status had been unanimously approved by the A.F.A. Board of Directors, Secretary Maloney declared the group officially inaugurated and then presented the rattle to Chairman Higson as its representative.

The group next proceeded to the election of officers and directors to serve for the balance of its fiscal year. J. L. Higson, who had served as chairman during the organizational period, was elected the first *Chairman* of the Rocky Mountain Empire chapter, and W. R. Manske, American Manganese Steel Div., American Brake Shoe Co., Denver, was named *Vice-Chairman*.

C. E. Stull, Manufacturers Foundry Corp., Denver, was elected *Secretary;* and J. W. Horner, Slack Horner Manufacturing Co., also of Denver, *Treasurer*.

Named as *Directors* were: J. E. Higson, Western Foundry Co.; B.

For these foundrymen, shown at the Oxford Hotel, Denver, January 14, is an historic date—the occasion of the formal installation of their Rocky Mountain Empire chapter as the Association's 35th husky "baby."

Rocky Mountain A.F.A. chapter, 35th of the Association, was formally installed on January 14 at the Oxford Hotel, Denver, Colo., by A.F.A. Secretary-Treasurer W. W. Maloney (left), shown with (left to right) Chapter Chairman J. L. Higson, Western Foundry Co.; Chapter Vice-Chairman W. R. Manske, American Manganese Steel Div., American Brake Shoe Co., Chapter Director P. M. Payne, Rotary Steel Castings Co., all, Denver.

E. Dixon, American Manganese Steel Div., American Brake Shoe Co.; S. C. Cooke, U. S. Foundries, Inc.; E. B. McPherson, McPherson Corp.; C. C. Drake, Griffin Wheel Co., and P. M. Payne, Rotary Steel Castings Co., all of Denver; R. A. Bolen, Bolen Mfg. Co., Grand Junction, Colo., and Jack Carter, American Foundry & Machine Co., Salt Lake City, Utah.

The slate of officers and directors was recommended by the nominating committee under chairmanship of E. B. Zabriskie, Magnus Metal Div., National Lead Co., Denver, who pointed out that it was clearly understood provision would be made each year for representation from outside the immediate Denver area. Included on the nominating committee were W. H. Bachman, C. S. Card Iron Works; B. E. Dixon; C. R. Kasch, Electron Corp., and A. L. Schneider, Western Bronze & Brass Foundry, all of Denver.

Following their election by unanimous vote, the new officers and directors were introduced; and, with Mr. Higson continuing in the chair and Secretary Stull taking over his duties from P. M. Payne, who had served as acting secretary, the meeting took up the matter of chapter by-laws.

W. R. Manske presented the set drawn up by a by-laws committee, appointed at an earlier meeting and of which he was chairman, and these were adopted with some minor amendments. Members of Mr. Manske's committee were J. W. Horner, P. M. Payne, E. B. McPherson and C. E. Stull.

At the conclusion of the business meeting, National Secretary Maloney spoke at length on the aims and purposes of A.F.A. as a technical society devoted specifically to the improvement of the "arts and sciences applicable to metal castings." He described the organization and operation of the Association, pointing out that the backbone of its activities was the structure of technical and practical committees, on which hundreds of proficient foundrymen and suppliers serve voluntarily to improve foundry practice and castings quality.

"Discussions at A.F.A. chapter meetings," Mr. Maloney explained, "are generally concerned with foundry technology and practices, rather than with wages, union contracts, labor problems, selling prices, legislation, or similar managerial problems." He urged foundry management to play an active part in the chapter's effort to advance the knowledge of foundry practice among those responsible for castings production, and declared that it is the concern of all to work for foundry progress and to make their plants worthy of the slogan "The Foundry is a Good Place to Work."

Philadelphia

H. V. Witherington
H. W. Butterworth & Sons, Inc.
Chapter Director

PERFORMANCE CHARACTERISTICS of various metals were described to members and guests of Philadelphia A.F.A. chapter, at the December 13 meeting in the Engineers Club, by J. B. Caine, Sawbrook Steel Castings Co., Cincinnati, whose topic was "What is Strength?"

J. A. Gitzen, Delta Oil Products Co., Milwaukee, addressed the November 8 meeting of Eastern Canada and Newfoundland A.F.A. chapter at the Mount Royal Hotel, Montreal, on "Properties of Binders Used in the Foundry." Seated, Chapter Chairman Henry Louette, Warden King, Ltd.

Technical chairman for the evening was Edward Barry, Dodge Steel Co., Philadelphia, who led an interesting and prolonged general discussion period.

The chapter Christmas Party, one of the highlights of the year, was held at the Benjamin Franklin Hotel on December 19. Attendance reached an all time high of approximately 500 members and guests. Chapter Chairman B. A. Miller, Cramp Brass & Iron Foundries Div., Baldwin Locomotive Works, Philadelphia, spoke briefly, welcoming those in attendance; and the balance of the evening was taken up with a turkey dinner and the floor show which followed.

Wisconsin

R. C. Woodward
Bucyrus-Erie Co.
Chapter Secretary

MEMBERS AND GUESTS of Wisconsin A.F.A. chapter gathered at the Hotel Schroeder, Milwaukee, on December 13 for the chapter's eleventh annual Christmas Party, one of the best in its history. Attendance was limited by hotel facilities to some 750, and the foundrymen, assembling early at their tables to the strains of "On Wisconsin," completely filled the ballroom and foyer.

The party arrangements committee, under chairmanship of Everett Carpenter, Carpenter Brothers, Inc., Milwaukee, won the high praise of all present for its work in preparation for the occasion. Following an excellent dinner, at which there were no speeches, the gathering enjoyed a floor show.

Northern California

C. R. Marshall
Chamberlain Co.
Chapter Co-Secretary

THREE PAPERS ON FOUNDRY technology were featured at the technical session of the Northern California A.F.A. chapter meeting of December 9 in the Engineers Club, San Francisco, with three members of the chapter making up the speakers panel for the evening.

Following the business session, Chapter President Richard Vosbrink, Berkeley Pattern Works, Berkeley, turned the meeting over to the program chairman, George McDonald, H. C. Macaulay Foundry Co., Berkeley, who introduced, in turn, D. C. Caudron, Pacific Brass Foundry, San Francisco; Chapter Vice-President A. M. Ondreyco, Vulcan Foundry Co., Oakland, and R. A. Wilson, Pacific Steel Casting Co., Berkeley.

Choosing "Melting Practices in Brass and Bronze" as his subject, Mr. Caudron pointed out that the quality and soundness of castings are vitally influenced by the condition of the melt when ready for pouring, and that the charge components, design of the furnace and type of fuel, are factors which materially affect melting conditions.

Combustion products must be taken into account, and variation between gas and oil products, considered: "Hydrogen and water are great enemies of good metal . . . Slight excess of gas prevents formation of oxides and makes for cleaner furnaces."

The speaker described the process of blowing compressed air through the molten metal as a final treatment before pouring, relating the favorable results obtained in his own experiences with the practice and citing technical references indicating that the practice improves pressure tightness and mechanical properties of bronze sand castings.

Mr. Wilson discussed "The Yardstick for Foundry Production of Steel." Taking as his premise, "It is the management's responsibility to operate manpower and equipment efficiently," he demonstrated planning methods by drawing up a list of operations performed and their logical sequence, sketching plant layout, and tracing the flow of work—all considered under original conditions, after certain changes, and under ideal conditions.

"Metallurgical Development of Gray Iron" was the topic selected by Mr. Ondreyco, who pointed out, "Through progress in the science of metallography, improvement in the quality and strength of gray iron has been great during the past

Scene at the Benjamin Franklin Hotel, Philadelphia, on December 19, when Philadelphia A.F.A. chapter welcomed a record attendance approaching 500 guests, to its Christmas Party and a banquet of turkey with all the "trimmings."

25 years." Photomicrographic technique in the study of metal structure as affected by alloying, melting conditions and heat treatment, has been a major factor in developing close control of melting, charge components, and proper pouring temperatures, he explained.

Rochester

D. E. Webster
American Laundry Machinery Co.
Chapter Secretary-Treasurer

"METALLURGY IN THE BRASS Foundry" was the subject of the technical session at the December 10 meeting of Rochester A.F.A. chapter in the Hotel Seneca, Rochester, N.Y., with W. B. George, R. Lavin & Sons, Inc., Chicago, as speaker of the evening.

Mr. George included in his comprehensive discussion: consideration of typical crystalline structures of non-ferrous alloys, proper furnace atmospheres, details of furnace design, and the effects of furnace and pouring temperatures on physical structures. He also described the types of gating required to promote directional solidification in various alloys. During the general discussion period, non-ferrous foundrymen of the area related their own experiences and broadened discussion of the evening's topic with many interesting questions.

At the business meeting, announcement was made of the election of J. H. Steeves, Corbett-Steeves Works, Rochester, to the chapter board of directors. The Directors chose Mr. Steeves to succeed J. H. McHenry, Gleason Works, Rochester, who has retired.

Metropolitan

B. K. Price
The Foundry
Chapter Reporter

AN EVENING OF ENTERTAINMENT was on the program for members and guests, some 430 in all, on December 13 at the Essex House, Newark, N.J., as Metropolitan A.F.A. chapter held one of its most successful Christmas parties.

Chapter Chairman H. L. Ullrich, Sacks-Barlow Foundries, Inc., Newark, presided and introduced T. D. Parker, Climax Molybdenum Co., New York, who acted as the chapter spokesman in presenting to A.F.A. National Director H. A. Deane, American Brake Shoe Co., New York, a gift in appreciation of his services as Chapter Chairman for 1945-46. A.F.A. National Director H. G. Lamker, Wright Aeronautical Corp., Paterson, N.J., was also introduced to the gathering.

Arrangements for the occasion were handled by the entertainment committee, headed by Chapter Director B. E. Beldin, Whitehead Brothers, New York, and including: Chapter Vice-Chairman K. A. DeLonge, International Nickel Co.; H. A. Robinson, Republic Steel Corp., and Ernest Miller, Bethlehem Steel Co., New York; D. S. Yeomans, George F. Pettinos Co., and F. B. Eliason, Pennsylvania Foundry Supply Co., Philadelphia; William Lawson, Springfield Facing Co., Newark; George Hadzima, Robins Conveyors, Inc.,

More than 430 members and guests were present for Metropolitan A.F.A. chapter's Christmas Party on December 13 at the Essex House, Newark, N.J.

Passaic, N.J.; D. W. Talbot, Cooper Alloy Foundry Co., Hillside, N.J.; E. B. Smith, American Brake Shoe Co., Mahwah, N.J.; Earl Morrow, Ingersoll Rand Co., Phillipsburg, N.J., and P. N. Nydegger, Singer Mfg. Co., Elizabethport, N.J.

Chicago

G. J. Biddle
Illinois Clay Products Co.
Chapter Reporter

ROUND TABLE MEETINGS provided a diversified technical program, on gray and malleable iron, steel and non-ferrous metals, for Chicago A.F.A. chapter, meeting January 6 at the Chicago Bar Association. Following the dinner and the introduction of speakers, the groups met simultaneously.

Gray iron foundrymen heard H. L. Campbell, Western Foundry Co., Chicago, speak on "Cupola Melting Practices," while Herbert Madsen, Whiting Corp., Harvey, Ill., sat as chairman.

L. B. Knight, Lester B. Knight & Associates, Inc., Chicago, addressed the malleable gathering on the subject of "Mechanization in Malleable Foundries." Frank Czapski, Chicago Malleable Castings Co., of that city, was chairman.

"Experiences in Permanent Molding" was the topic for the non-ferrous session, with L. G. Jessup, Federated Metals Div., American Smelting & Refining Co., Chicago, as speaker and Chapter Director Oscar Blohm, Triangle Foundry Co., Chicago, in the chair.

In the steel division, the subject was "Mechanism of Stress Relief," presented by C. F. Christopher, Continental Foundry & Machine Co., East Chicago, Ind., who had as his chairman F. S. Sutherland, of the same firm.

Michiana

S. F. Kreszewski
American Wheelabrator & Equipment Corp.
Chapter Director

NATIONAL OFFICERS and top-management night was observed by Michiana A.F.A. chapter at its December 3 meeting in the Hotel LaSalle, South Bend, Ind. Chapter Chairman John McAntee, Covel Manufacturing Co., Benton Harbor, Mich., presided and, after extending the welcome of the chapter to top management representatives from local foundries, he introduced W. W. Maloney, A.F.A. Secretary-Treasurer.

Mr. Maloney greeted the foundrymen in the name of the Association's National Officers, and outlined briefly the privileges and advantages of membership in the American Foundrymen's Association. He cited the benefits derived by all members from the free exchange of valuable information on foundry technology; the experience and information gained through participation in the development of foundry standards, practices and research, on Association committees; and the opportunity to obtain, through the A.F.A. national organization, assistance and cooperation in chapter activities and in the solution of foundry problems.

In speaking of the national activities of the Association, Mr. Maloney paid special tribute to the members who devote their assistance and efforts to committee work

Wisconsin A.F.A. chapter members and their friends completely filled the ballroom and foyer of the Hotel Schroeder, Milwaukee, for the chapter Christmas Party on December 13. The camera of Chapter Director John Bing, A. P. Green Fire Brick Co., Milwaukee, recorded in these scenes the enjoyment of the foundrymen on the occasion.

Dr. R. L. Lee (center), General Motors Corp., Detroit, speaker of the evening at the December 6 meeting of Ontario A.F.A. chapter at the Prince Edward Hotel, Windsor, explains a point on leadership to H. M. Gregory (left), Walker Metal Products, Ltd., Walkerville, Ont., and Chapter Chairman J. A. Wotherspoon, Imperial Iron Corp., Ltd., St. Catherines.

on the development of practices and methods for more efficient foundry production; and he informed chapter members of a new series of technical publications, soon to be issued by A.F.A. as a result of the work of such groups.

Following Mr. Maloney's remarks, Chapter Director Earl Byers, Sibley Machine & Foundry Co., South Bend, who serves as chairman of the program committee, introduced the speaker of the evening, G. R. Targett, of his firm.

Mr. Targett, discussing foundry cost accounting fundamentals, emphasized that accurate costs can be determined only through the use of proper foundry accounting procedures. He presented a number of formulas and went into detail in citing instances of their applications and the results profit-and-loss statementwise. The speaker urged constant analysis of costs on the part of foundrymen, in the interests of research into methods of improving foundry operations.

Twin City

RECORD ATTENDANCE marked the annual Christmas Party of Twin City A.F.A. chapter, as some 465 members and guests gathered at the Radisson Hotel, Minneapolis, on December 19. Good fellowship was the keynote of the evening, which opened with a social hour, followed by a buffet supper, and concluded with a diversified entertainment program. Arrangements were handled by N. E. Wisner, Foundry Supply Co., St. Paul., Minn., and his committee.

Western Michigan

K. C. McCready
Muskegon Piston Ring Co.
Chapter Reporter

REASONS AND CURES for unsatisfactory cupola operation were detailed to foundrymen at the Western Michigan A.F.A. chapter meeting of January 13, at the Hotel Schuler, Grand Haven, by T. E. Barlow, Battelle Memorial Institute, Columbus, Ohio, who spoke on "Sensible Cupola Operation."

Drawing from his extensive foundry background, Mr. Barlow included in his comprehensive talk consideration of blowers, piping, wind boxes, tuyeres, stock height, diameter of cupola, height of bed, coke sizes, and many other aspects of the subject. Good supervision was high on the speaker's list of recommendations; he pointed out that satisfactory equipment and practices are not enough for successful foundry operation—there must be intelligent supervision, proper production records.

Mr. Barlow was introduced at the technical session by Harold Meyers, Sealed Power Corp., Mus-

Chapter Chairman B. A. Miller, Baldwin Locomotive Works, and entertainment committee chairman William Gallana, Rogers, Brown Lavino Co. (respectively, third and fourth from left, front), both of Philadelphia, are shown with other members of the entertainment committee, which handled arrangements for Philadelphia A.F.A. chapter's Christmas Party, the season's highlight in the Benjamin Franklin Hotel on December 19.

Officers of Central New York A.F.A. chapter pause for the photographer at the January 10 meeting in the Onondaga Hotel, Syracuse: left to right, E. E. Hook, Dayton Oil Co., Syracuse, Chairman; M. H. Hollenbeck, Kennedy Valve Manufacturing Co., Elmira, Treasurer; R. A. Minnear, Ingersoll-Rand Co., Painted Post, Vice-Chairman, and C. M. Fletcher, Fairbanks Co., Binghampton, Secretary.

kegon. Chapter Chairman Rudolph Flora, Clover Foundry Co., Muskegon, was the presiding officer for the evening, and attendance reached a record high of 112.

At the November 11 meeting of the chapter, in the Hotel Schuler, Dr. C. R. Austin, Meehanite Metal Corp., New Rochelle, N. Y., described and analyzed new developments in the "Heat Treatment of Castings."

The speaker, who was introduced by I. K. McGregor, Campbell, Wyant & Cannon Foundry Co., Muskegon, stated the four main objectives of heat treatment as: 1), annealing for stress relief; 2), annealing for improved machinability; 3), heating and quenching for hardness, and, 4), heating, quenching and drawing to increase strength and hardness.

Wisconsin Management Session

INDUSTRYWIDE, constant progress in foundry techniques should be the deep concern of top management of every foundry, A.F.A. National President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, told the more than 40 Milwaukee area castings industry executives who were luncheon guests of Wisconsin A.F.A. chapter January 14 at the Schroeder Hotel, Milwaukee, Wis.

Others who spoke at the management luncheon, a prelude to the chapter's National Officers Night program, were National Secretary-Treasurer W. W. Maloney and R. M. Jacobs, Standard Brass Works, Milwaukee, A.F.A. national director in 1943-46 and a past chairman of the Wisconsin group. Chapter Chairman D. C. Zuege, Sivyer Steel Castings Co., Milwaukee, presided and introduced the speakers to the management representatives.

Since the design engineer may consider the quality of any lot of castings a criterion of the abilities of the foundry industry as a whole, every producer of castings, whatever his metal, must concern himself with the industrywide level of technical ability and efficiency, President Wood pointed out. That concern demands, in turn, participation in and support of activities designed to advance techniques, educate employees and secure widespread adoption of improved methods, he added.

Founding is no longer a "mysterious art," and iron-curtained plants are less likely to be hiding exclusive processes than cutting themselves off from real progress, he asserted. The best guarantee of progress, he declared, is not found in isolationism but in willingness to contribute to the discussion of common problems and to cooperate in efforts to improve all practices and processes.

He urged management to participate actively in the industry's cooperative efforts and to encourage employees to take full advantage of the opportunity A.F.A. affords for new contacts, new viewpoints and new techniques. Management, he said, must evidence a real enthusiasm for the foundry industry and engender and foster enthusiasm on the part of employees. Pride in industry can be built through the cooperative activity medium, he declared.

Secretary Maloney described the organization and operations of A.F.A. and outlined the many ways in which it is serving the professional interests of foundrymen. He characterized the association as "a cooperative, educational institution created to advance metal castings sciences," and praised the work of foundrymen on the Association's committees.

In a discussion of the work of the Wisconsin chapter, Mr. Jacobs said that sectional meetings had proved very popular and that considerable emphasis is placed on the annual regional conference and on cooperation with the University of Wisconsin and the vocational schools of the area. He stressed that chapter members lecture on foundry practice at the University, and that the group maintains a scholarship fund to enable deserving young men to continue their studies of foundry technology.

New type of gavel in use at Michiana A.F.A. chapter meetings, made by J. H. Miller, Josam Products Foundry Co., Michigan City, Ind., current Chapter Vice-Chairman, and accepted for the chapter by the then Chapter Chairman W. V. Johnson, Oliver Farm Equipment Co., South Bend, Ind. Shovel and rod are both chromium plated, and when the latter is struck against the former, attention of the meeting is assured.

Chapter Chairman E. E. Hook (at left, top), Dayton Oil Co., Syracuse, welcomed 260 foundrymen to the Central New York chapter Christmas Party, December 14 at the Onondaga Hotel, Syracuse. Center, some of the guests in action; bottom, the party arrangements committee.

Board Approves New Chapter At Tulsa

UNANIMOUS APPROVAL of the petition for formation of the Tri-State chapter—36th of the Association—with headquarters at Tulsa, Okla., was voted by the A.F.A. Board of Directors, at its mid-year meeting on January 23 in the Palmer House, Chicago. The new chapter thus acquired the unique distinction of consideration of its application at a regular meeting of the Board, rather than by the usual letter ballot.

The petition, signed by 79 foundrymen representing 29 separate organizations, was sponsored by the following officers, elected at the December 6 meeting in Tulsa:

Chairman, R. W. Trimble, Bethlehem Supply Co., Tulsa.

Vice-Chairman, Anton Johnson, Oklahoma Steel Castings Co., Tulsa.

Secretary, C. A. McNamara, Jr., Big Four Foundry Co., Tulsa.

Treasurer, F. G. Lister, Chicago Pneumatic Pump Co., Tulsa.

Territory of the new chapter, which will be officially installed at an early date, includes the area bounded by Wichita, Coffeyville and Pittsburg, Kan., on the north; Webb City and Joplin, Mo., and Muskogee, Okla., on the east; McAlester, Okla., on the south, and Oklahoma City, Enid and Blackwell, Okla., on the west.

Central New York

J. A. Feola
Crouse-Hinds Co.
Chairman, Publicity Committee

"SOMETHING NEW" concerning the preparation of molding and core sands was promised the foundrymen at the January 10 meeting of Central New York A.F.A. chapter in the Onondaga Hotel, Syracuse, by speaker of the evening Charles Schureman, Baroid Sales Div., National Lead Co., Joliet, Ill., who spoke on "Bonding Molding Sands."

As the speaker covered each phase of the selection and preparation of foundry sands, he explained that the "something new" is correct and careful observance of procedures already known to foundry-

Members of the arrangements committee for Eastern Canada and Newfoundland chapter's "Ladies Night Supper Dance," pause for the camera after disposing of final details for the party, which drew an attendance of 490 to the Mount Royal Hotel, Montreal, on December 13. Front row, left to right: Chapter Secretary R. E. Cameron, Webster & Sons, Ltd.; Chapter Treasurer L. G. Guilmette, Canadian Foundry Supply & Equipment Co., Ltd.; Chapter Director John Shewan, Canadian Car & Foundry Co., chairman of the committee, and Chapter Chairman Henry Louette, Warden King, Ltd., all of Montreal.

men—but often taken for granted and followed only haphazardly.

Mr. Schureman's remarks were concerned with selection of a base sand of the grain fineness necessary, considering the size of the casting and surface finish desired; the use of proper bonding materials for the job; careful mixing for the length of time necessary to insure proper blending; close check on moisture, and periodic laboratory tests as a check on blending operations for the desired mixture.

Many of the difficulties encountered in sand blending, the speaker asserted, can be traced to the use of containers of improper size. He urged the weighing of all ingredients, or, at least, a careful determination of the capacities of all measures. Once a satisfactory sand mixture has been found, Mr. Schureman concluded, care should be taken that all procedures involved are carefully followed, so that the mixture can be duplicated successfully for as long as necessary.

Mr. Schureman was introduced by Chapter Chairman E. E. Hook, Dayton Oil Co., Syracuse, presiding.

New England

M. A. Hosmer
Hunt-Spiller Mfg. Corp.
Association Reporter

ELECTION OF OFFICERS was the only business of the evening at the Annual Meeting of the New England Foundrymen's Association, in the Parker House, Boston, on January 9.

D. L. Parker, General Electric Co., West Lynn, Mass., was named *President;* and A. F. Dockry, H & B American Machine Co., Pawtucket, R. I., *Vice-President* and chairman, executive committee.

As *Treasurer,* the members chose A. W. Gibby, East Boston, Mass.; as *Secretary,* E. F. Stockwell, Barbour-Stockwell Co., Cambridge.

Members of the executive committee, in addition to Mr. Dockry, are: F. M. Fitzgerald, Draper Corp., Hopedale, Mass.; T. I. Curtin, Waltham Foundry Co., Waltham, Mass.; R. C. Walker, Whitin Machine Works, Whitinsville, Mass.; F. R. Elliot, Westinghouse

(*Continued on Page 78*)

Some of the merriment of the more than one thousand foundrymen who were in attendance at the Carter Hotel, Cleveland, on December 12, is shown in these scenes from the Northeastern Ohio A.F.A. chapter Christmas Party.

(Photos courtesy S. N. Farmer, Sand Products Corp.)

CHAPTER MEETINGS
FEBRUARY-MARCH

FEBRUARY 17

QUAD CITY

Fort Armstrong Hotel
Rock Island, Ill.
E. T. KINDT
Kindt-Collins Co.
Timely Comments on Pattern Engineering

FEBRUARY 20

DETROIT

Rackham Educational Memorial
GROUP MEETINGS

OREGON

Heathman Hotel, Portland
G. R. BOGUE
General Tool Co.
Abrasives
HARRY CZYZEWSKI
Metallurgical Engineers, Inc.
Modern Foundry Research

FEBRUARY 21

TEXAS

Rice Hotel, Houston
D. J. MARTIN
Hughes Tool Co.
The Future of Castings in Highly Stressed Machine Parts

NORTHWESTERN PENNSYLVANIA

Arlington Hotel, Oil City
DR. J. A. RIDDERHOF
Frederic B. Stevens, Inc.
Core Washes to Prevent Penetration

FEBRUARY 24

NORTHWESTERN PENNSYLVANIA

Moose Club, Erie
W. E. SICHA
Aluminum Co. of America
Aluminum Alloy Castings

FEBRUARY 27

CENTRAL OHIO

Chittenden Hotel, Columbus
ROUND TABLE DISCUSSIONS

FEBRUARY 28

CHESAPEAKE

Engineers Club, Baltimore, Md.
F. L. OVERSTREET
Illinois Clay Products Co.
Sand Properties and Their Relation to Casting Defects

MARCH 3

CENTRAL ILLINOIS

Jefferson Hotel, Peoria
C. E. BALES
Ironton Firebrick Co.
Modern Foundry Refractories

METROPOLITAN

Essex House, Newark, N. J.
NATIONAL OFFICERS NIGHT

CHICAGO

Chicago Bar Association
ROUND TABLE DISCUSSION

CENTRAL INDIANA

Athenæum, Indianapolis
ROUND TABLE DISCUSSIONS
NATIONAL OFFICERS NIGHT

MARCH 4

MICHIANA

Spaulding Hotel, Michigan City, Ind.
J. B. CAINE
Sawbrook Steel Castings Co.
What Do We Know About Sand?

MARCH 6

SAGINAW VALLEY

ZIGMOND MADACEY
Caterpillar Tractor Co.
Core Blowing

MARCH 7

MEXICO CITY

Barcelona 11, Second Floor

WESTERN NEW YORK

Hotel Touraine, Buffalo
B. L. SIMPSON
National Engineering Co.
The History and Development of the Foundry Industry

MARCH 11

ROCHESTER

Seneca Hotel, Rochester, N. Y.
PETER BLACKWOOD
Ford Motor Co. of Canada, Ltd.

MARCH 10

CINCINNATI DISTRICT

Engineering Society Headquarters, Cincinnati

MARCH 13

ST. LOUIS DISTRICT

DeSoto Hotel, St. Louis
S. G. GARRY
Caterpillar Tractor Co.
Human Relations in the Foundry

MARCH 14

PHILADELPHIA

Engineers Club
NON-FERROUS NIGHT

EASTERN CANADA-NEWFOUNDLAND

Mount Royal Hotel, Montreal

NORTHEASTERN OHIO

Cleveland Club, Cleveland
ROUND TABLE DISCUSSIONS
Good Patterns and Good Castings

NORTHWESTERN PENNSYLVANIA

Meadville
CLYDE SAUNDERS
American Colloid Co.
Foundry Sand Practice

COMING FOUNDRY CONFERENCES

FEBRUARY 20-22

BIRMINGHAM DISTRICT

Tutwiler Hotel, Birmingham, Ala.
FIFTEENTH ANNUAL CONFERENCE

FEBRUARY 28-MARCH 1

EASTERN CANADA-NEWFOUNDLAND AND ONTARIO

Royal York Hotel, Toronto
CANADIAN CONFERENCE

MARCH 28-29

NEW ENGLAND FOUNDRYMEN'S ASSOCIATION

Massachusetts Institute of Technology, Cambridge
SEVENTH NEW ENGLAND CONFERENCE

Electric Corp., East Springfield, Mass., and C. A. Reed, Cambridge.

Nominations were presented by a committee under chairmanship of Raymond Meader, Whitin Machine Works, and including W. M. Saunders, Providence, R. I., and M. A. Hosmer, Hunt-Spiller Manufacturing Corp., Boston.

Following the business session, dinner was served to more than 300 members and guests, and a program of entertainment concluded the evening's activities.

At the regular meeting of the association on December 11, in the Engineer's Club, Boston, the technical session featured a round table discussion under supervision of a "Board of Experts," headed by R. F. Harrington, Hunt-Spiller Manufacturing Corp., as Chairman.

Other members of the "Board" were: W. M. Saunders; Henry Sternberg, Draper Corp.; Charles Bailey, Patch-Wagner Co., Rutland, Vt., and J. B. Stazinski, General Electric Co., Lynn, Mass. Each presented a brief address on a foundry problem, and answered questions put by the audience. Many interesting problems were raised for discussion, and some difficult castings were exhibited.

Chapter officers and directors of Central Illinois A.F.A. chapter: left to right, Directors (standing) F. W. Shipley, Caterpillar Tractor Co., Peoria, Ill.; L. E. Roby, Peoria Malleable Castings Co., Peoria; C. W. Buckler, Superior Foundry Co., East Peoria, Ill.; A. M. Klawitter, M. H. Detrick Co., Peoria, and (seated) V. W. A'Hearn, Midwest Pattern Works, of the same city; Chapter Secretary-Treasurer G. H. Rockwell, Caterpillar Tractor Co.; Chapter Chairman Zigmond Madacey, Caterpillar Tractor Co., and Vice-Chairman A. V. Martens, Pekin Foundry & Mfg. Co., Pekin.
(Photo courtesy Caterpillar Tractor Co.)

Canton Management Session

A SPECIAL management luncheon meeting sponsored by the Canton District chapter and composed of local foundry executives and representatives of top management was held January 16 in the Onesto Hotel, Canton, Ohio. The principal speaker was A.F.A. National Vice-President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Emphasizing the necessity of continuing to improve working conditions in the foundry, Mr. Kuniansky urged owners of foundries to clean up their shops and practice good housekeeping. The installation of exhaust systems was stressed as well as the need for providing proper locker, toilet and lunch room facilities.

Prior to the address by Mr. Kuniansky the meeting was opened by I. M. Emery, Massillon Steel Castings Co., who gave a brief talk. Mr. Emery, Chairman, Canton District chapter, explained the activities of the local chapter and the numerous benefits derived by foundries whose men participate.

Representing the National Office at the gathering was S. C. Massari, A.F.A. Technical Director, Mr. Massari explained to the assemblage the workings of the Association and how both chapter and committee personnel were the backbone of the association.

Among those at the speakers table when Ontario A.F.A. chapter held its November 9 meeting in the Royal Connaught Hotel, Hamilton, were: left to right, Chapter Director R. T. Wilson, Ontario Malleable Iron Co. Ltd., Oshawa; J. E. Rheder, Grinnell Co. of Canada, Ltd., Toronto; Chapter Chairman J. A. Wotherspoon, Imperial Iron Corp., Ltd., St. Catharines; Secretary-Treasurer G. L. White, Westman Publications, Toronto.

Canton District

C. B. Williams
Massillon Steel Castings Co.
Chapter Secretary

RECENT DEVELOPMENTS in methods for the production of sound castings were detailed to members and guests of Canton District A.F.A. chapter, meeting December 12 at Yants Cottage, Canton, Ohio, by F. G. Sefing, International Nickel Co., New York, and Chairman of the Association's new Educational Division.

The speaker emphasized the importance of proper design in enabling the foundrymen to obtain high-quality castings, and suggested closer coordination between designer and manufacturer. He also went into detail regarding improved techniques in gating and heading, presenting slides to illustrate practices under consideration.

Central Ohio

D. E. Krause
Battelle Memorial Institute
Chapter Reporter

FOUNDRYMEN of ancient times must have exercised the greatest perseverance against obstacles and heartbreak, to achieve the results of which we have record, A.F.A. National Director B. L. Simpson, National Engineering Co., Chicago, told modern foundrymen at the technical session of Central Ohio A.F.A. chapter's December 16 meeting in the Chittenden Hotel, Columbus.

Mr. Simpson reviewed "The History of the Foundry Industry," presenting numerous slides to demonstrate the progress in the art of casting metals. Large, as well as intricate, castings were produced in a day when the foundryman did not have the benefit of modern scientific knowledge, equipment or instruments, he explained; yet, those surviving are works of art.

Central Illinois

G. H. Rockwell
Caterpillar Tractor Co.
Chapter Secretary-Treasurer

SHIFTING the meeting day to Sunday, in order to permit attendance of members working on late shifts, Central Illinois A.F.A. chapter held its Christmas Party on December 15 at the American Legion Home, Peoria, and welcomed more than 250 foundrymen to an evening of entertainment. The event was adjudged such a huge success that chapter officers are looking forward to its continuance as an annual chapter season highlight. A vaudeville program followed the excellent turkey dinner, and Chapter Vice-Chairman A. V. Martens, Pekin Foundry & Manufacturing Co., Pekin, Ill., and members of his entertainment committee were accorded the thanks of the chapter.

No. Illinois-So. Wisconsin

H. J. Bauman
Ebaloy, Inc.
Chapter Secretary

GUEST SPEAKER at the November 12 meeting of Northern Illinois and Southern Wisconsin A.F.A. chapter, at the Hotel Hilton, Beloit, Wis., was C. E. Westover, Westover Engineers, Milwaukee, who spoke on the various aspects and importance of cost control.

Interest of the members was indicated during the general discussion period, especially in such aspects as reduction of scrap and proper organization and division of responsibility in management.

St. Louis District

J. W. Kelin
American Smelting & Refining Co.
Chapter Reporter

FOUNDRY MAINTENANCE proved a subject of unusual interest to approximately 125 members and guests of St. Louis District A.F.A. chapter at the January 9 meeting in the DeSoto Hotel, St. Louis. Three papers on the topic were presented at the technical session; the first, on "Requirements of a Maintenance Supervisor," by A. H. Lauer, American Steel Foundries, Granite City, Ill., who also served as chairman for the program.

"Mechanical and Improved Equipment in Steel Foundries" was the subject of the second speaker, J. W. Buck, Scullin Steel Co., St. Louis; and William Howell, General Steel Castings Corp., Granite City, considered "Modern Electrical Appliances in Steel Foundries" in the third paper.

Some scenes from the October 11 meeting of Northeastern Ohio A.F.A. chapter, at the Cleveland Club. At center, top, Chapter President H. J. Trenkamp, The Ohio Foundry Co., Cleveland, is shown as he introduced T. E. Barlow, Battelle Memorial Institute, Columbus, Ohio.

(Photos courtesy S. N. Farmer, Sand Products Corp.)

Book Reviews

Dictionary of Machine Shop Terms, by Arthur C. Telford, 292 pages. Price, 75 cents. American Technical Society, Chicago. 1947.

Dictionary of Machine Shop Terms is a convenient shirt-pocket size reference book. Briefly defining about 2200 terms, this book does not confine itself to machine shop terms, but includes a number of definitions related to heat treating and forging, welding, and the castings industry. The number of chemical and physical terms defined may illustrate a trend in vocational training toward more interest in the basic sciences. In general, the words and terms which make up this dictionary seem to be well chosen and probably are the result of many years experience in teaching and answering questions. Nevertheless, it is a bit surprising to find in this dictionary words which have no special significance in the field of shop terms and which are common in newsprint and everyday conversation. The inclusion of such colloquialisms as *make tracks* seems superfluous in a work of this nature.

Foundrymen will be surprised to find the definition for *nowel,* a term not often heard in foundries today. Also, they may be a little unhappy at finding the word *fault* illustrated by the phrase "as a fault in a casting." Foundry terms and those related to other metallurgical processes are rather vague and often misleading or incorrect. In achieving brevity, the author has made generalizations which indicate that cast iron is "hard, brittle" and that cast steel is "a tough slow machining steel."

In defining *crystallize,* the common mistake of assuming that anything which has a crystalline structure (and this means most materials) must necessarily be brittle has been made. This idea is closely related to the two erroneous notions that a part which fails due to long repeated stress reversal has crystallized, and has thereby been embrittled.

The explanation that wrought iron contains "about one-half of one percent of carbon" possibly results from misreading 0.05% during the preparation of the dictionary. And the statement that wrought iron "is most commonly made by *purifying* cast iron by the puddling process" will be a disappointment to cast iron metallurgists, as well as to the holders of the patents on the modern method of making wrought iron.

Despite these and other shortcomings, which may be of minor significance to a vocational school student or an apprentice, this little book may be used widely at that educational level.

The Aluminum Industry, by Stanley V. Malcuit. Fourth in the series of American Industries monographs. 36 pages, 6x9-in. format. Price, $1.00. Bellman Publishing Co., 83 Newbury Street, Boston 16. 1946.

This pamphlet, for individual reference in choice of a career or for guidance in vocational counseling, presents an outline of the aluminum industry and its products. Personal qualifications required for employment in the industry; scholastic training needed; opportunities for employment and advancement, and salaries are discussed; and advantages and disadvantages of the field, noted.

Of special interest is an analytical index of occupations, which directs the reader to pertinent information in the chapter on "Typical Jobs in the Industry."

RECOMMEND RESEARCH PROJECT For Light Metals Division Sponsorship

STUDY OF "The Application of Hydraulic Principles in Gating and Risering of Light Metal Castings" was recommended by the Research Committee, A.F.A. Aluminum and Magnesium Division, meeting December 13 at the Hotel Statler, Cleveland. Dr. R. F. Thomas, International Nickel Co., Detroit, Chairman of the group, presided at this first meeting of a divisional research committee under the revised plan of technical activities recently approved by the A.F.A. Board of Directors.

The proposal of the study, which would cover such aspects as: turbulence of flow in molten metal entering the mold cavity, resistance of mold materials to the flow viscosity of the molten metal, and oxide-forming properties of mold materials, will be drawn up in detailed written form and forwarded to the National Office, prior to submittal for consideration of the Executive Committee of the Association. Decision on recommendation of the project was reached after lengthy discussion of a number of suggested subjects for research activities of the Division.

Project Personnel

W. E. Sicha, Aluminum Co. of America, Cleveland, serves as Vice-Chairman of the Research Committee, and acting as its advisory group are: Division Chairman R. E. Ward, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., and W. E. Martin, National Smelting Co., Cleveland, and Chairman, Program and Papers Committee of the Division.

Other members of the Research Committee are: C. E. Nelson, Dow Chemical Co., Midland, Mich.; T. D. Stay, Reynolds Metals Co., Cleveland; Walter Bonsack, National Smelting Co., Cleveland, and W. J. Klayer, Aluminum Industries, Inc., Cincinnati.

Present Lecture Course at Southern California

FIVE LECTURES on foundry metallurgy, comprising the third annual educational program of Southern California A.F.A. chapter, have been scheduled for consecutive Mondays, January 27 through February 24, at Edison Auditorium, Los Angeles.

For the first four sessions, which will be on (in chronological order) "Physical Metallurgy and the Foundry," "Steel," "Cast Iron" and "Non-Ferrous Castings," the lecturer will be James R. Cady, assistant professor in mechanical engineering, University of Southern California, Los Angeles. Edwin K. Smith, consulting metallurgist, Beverly Hills, will conclude with, "Machinability of Castings."

ABSTRACTS

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications.

When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th St., New York, N. Y.

Copper-Base Alloys

BRASS MELTING. Harbach, G. L., and Hudson, F., *"Fuel Efficiency in the Brass Foundry Pays Dividends,"* FOUNDRY TRADE JOURNAL, October 3, 1946, vol. 80, no. 1572, pp. 105-108.

A review of early work and results achieved in connection with fuel economy. Article gives comparative data on coke and oil fuel melting, and examples of further economies which may be adapted more generally in the future.

BRONZE. Roast, Harold J., *"Bronze Castings,"* CANADIAN METALS AND METALLURGICAL INDUSTRIES, October, 1946, vol. 9, no. 10, pp. 25-28.

Answers to questions about alloys, sands, molding technique, melting, and inspection.

EFFECTS OF SECTION SIZE. Austion, C. R., *"Test Bar Data v. Casting Properties,"* THE IRON AGE, September 26, 1946, vol. 158, no. 13, pp. 70-73.

The author explains the reasons why the tensile properties obtained from the 1.2-in. arbitration bar are misleading when an attempt is made to apply the data to castings of greater dimensions. The significance of solidity penetration power is also described.

GRAIN GROWTH. Nichols, H. J., *"Reducing Cast Iron Grain Growth,"* STEEL, November 4, 1946, vol. 119, no. 19, pp. 101, 148.

Application of a layer of aluminum oxide to the surface of an iron casting will greatly reduce growth on exposure to hot gases.

SPECTROGRAPHIC ANALYSIS. Hurst, J. E., and Riley, R. V., *"Cast Iron,"* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 709-714.

Advantages of spectrographic over orthodox chemical operations; apparatus used; considerations governing design of the laboratory; sampling of cast iron; spectrographic method; analysis of cast iron; routine procedure; and accuracy of spectrographic method.

STRESS-CORROSION. Urban, J. B., Bolton, J. W., and Smith, A. J., *"Some Stress-Corrosion Studies on Austenitic Cast Irons,"* TRANSACTIONS OF THE A.S.M.E., August, 1946, vol. 68, no. 6, pp. 633-636.

An investigation of corrosion rates of cast iron under stress indicated that for the corrosive and temperature considered there is a limiting stress below which the effects of stress corrosion on austenitic irons are either negligible or nonexistent. This stress is relatively high in respect to contemplated stresses for cast-iron products. Thus the good corrosion resistance of these metals in hot caustic can be advantageously utilized as sound engineering practice.

STRESS RELIEF. Russell, P. A., *"Heat-Treatment of Grey Cast Iron for Relief of Internal Stresses,"* FOUNDRY TRADE JOURNAL, September 5, 1946, vol. 80, no. 1568, pp. 3-9.

A description of a series of experiments devised to ascertain the amount of relief of internal stress by heat-treatment in the range of 400 to 600 deg. C., and at the same time to study the effect on the physical properties. The irons studied were all high-duty irons. The effects of exposing specimens to atmospheric weathering and to prior machining were also investigated. A test-piece having internal stresses caused by irregular sections was used, and the amount of stress estimated by movement of a gap cut in the heavy section.

SULPHUR. Morrogh, H., *"Cast Iron."* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 719-724.

An investigation of the neutralization of sulphur in cast iron by various alloying elements. Experiments were performed on low-manganese, high-sulphur irons.

WEAR RESISTANCE. Ballay, Marcel, and Chavy, Raymond, *"Some Notes on Hard Wear-Resisting Cast Irons and Steels,"* (Translation of French Exchange Paper to the Institute of British Foundrymen), FOUNDRY TRADE JOURNAL, September 19, 1946, vol. 80, no. 1570, pp. 55-61.

A classification and brief description of methods available to the metallurgist for obtaining a hard, wear-resistant cast iron. One steel also was considered.

Inspection

FLUOROSCOPIC. Close, Gilbert C., *"Fluoroscopy of Aluminum,"* LIGHT METAL AGE, October, 1946, vol. 4, no. 10, pp. 14-17.

Advantages and disadvantages of fluoroscopic inspection of light metal parts, and arguments for its substitution for a large portion of radiographic inspection.

Magnesium-Base Alloys

MELTING. Lorig, C. H., *"A New Method for Melting Magnesium,"* METAL PROGRESS, November, 1946, vol. 50, no. 5, pp. 1020-1022.

An account of treatment with a combination of chlorine and carbon tetrachloride to eliminate the need for superheating for grain refinement. Also a description of a metal transfer mechanism consisting of a tubular furnace with its burner, discharge and return pipe, and a centrifugal pump.

Malleable Cast Iron

ANNEALING RATE. Covey, D. M., and Jenkins, I., *"Annealing Rate in Gaseous Malleablising,"* FOUNDRY TRADE JOURNAL, September 19, 1946, vol. 80, no. 1570, pp. 63-68.

Mechanism of malleablizing, application of diffusion laws, and empirical relationship between thickness of casting, time of anneal and mean residual carbon content.

Materials Testing

PREDICTING FAILURE. Cavanagh, P. E., *"A Method for Predicting Failure of Metals,"* A.S.T.M. BULLETIN, December, 1946, no. 143, pp. 30-35.

A discussion of the possibilities of using changes in high frequency magnetic and eddy-current losses to predict failure in metals.

Mechanical Handling

POURING. Shepard, J. R., and Olson, W. J., *"Mechanical Pouring Unit Handles 11 Tons Per Hour,"* THE IRON AGE, December 5, 1946, vol. 158, no. 23, pp. 77-80.

A description of a centralized system of pouring which utilizes push-button control. The system, which is installed at American Brake Shoe, has converted the pouring operation from several difficult jobs requiring five or six pourers to one requiring but one operator working in safety and comfort.

Metallography

COATED LENSES. Waden, Edward, *"Use*

of Coated Lenses for Metallography," METAL PROGRESS, November, 1946, vol. 50, no. 5, pp. 1097-1099.

Advantages of coating objective lenses with fluoride compounds having a low index of refraction.

METALLOGRAPHIC MOUNTS. Kehl, George L., and Church, James S., *"Room Temperature Casting Resin for Metallographic Mounts,"* METAL PROGRESS, November, 1946, vol. 50, no. 5, pp. 1089-1090.

Use of a partially polymerized methyl methacrylate monomer which can be cast at ordinary pressures and temperature not exceeding 120° F. After casting the resin hardens and becomes completely polymerized.

Sand

ALUMINUM FOUNDRY. Parker, William G., *"Synthetic Sand in an Aluminum Foundry,"* ALUMINUM AND MAGNESIUM, November, 1946, vol. 3, no. 2, pp. 16-18, 24.

Development of a synthetic sand for aluminum castings and a review of sand testing with emphasis on the need for a sound base for the A.F.A. sand rammer.

Steel

GRAPHITIZATION. Kanter, J. J., *"Studies on Susceptibility of Casting Steels to Graphitization,"* TRANSACTIONS OF THE A.S.M.E., August, 1946, vol. 68, no. 6, pp. 581-587.

A survey of the difference in graphitization susceptibility and stability of high-temperature properties in the carbon-molybdenum cast steels as made by various electric melting processes, and in steels with a silicon addition plus ½ lb. aluminum per ton.

HYDROGEN REMOVAL. Andrew, J. H., Lee, H., Mallik, A. K., and Quarrell, A. G., *"Hydrogen in Steel,"* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 665-681.

An account of work undertaken to determine the temperature at which hydrogen could most readily be removed, and in what way this temperature depended upon the composition of the steel. Considerable information was obtained concerning the formation of hair-line cracks.

RADIOGRAPHY. Keating, F. H., *"Steel Castings,"* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 725-729.

An account of a practical attempt to use the radiographic technique in the production of high quality castings for a specific duty.

SLAG REACTIONS. Balajiva, K., Quarrell, A. G., and Vajragupta, P., *"Basic Steelmaking,"* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 645-653.

Development of a suitable laboratory technique and application of method to the study of the phosphorus reaction in the basic steelmaking process. Apparatus and experimental procedure; analytical procedure; range of slag and metal compositions employed in the present work; experimental results; treatment of results; slag constitution; statistical treatment of analytical results; conclusions; bibliography.

TEMPERATURE MEASUREMENT. Manterfield, D., and Thurston, J. R., *"Liquid Steel Temperatures,"* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 695-697.

A description of an improved design of immersion pyrometer which is attached to the back-wall binding. The new pyrometer simplifies the operation of temperature measurement, cuts down maintenance, and reduces embrittlement troubles.

THERMAL AND ELECTRICAL PROPERTIES. *"Physical Properties of Steels,"* IRON AND STEEL, November 21, 1946, vol. 19, no. 13, pp. 751-753.

Determination of certain physical properties of a number of steels which enter into calculations concerning heating and cooling problems, such as specific heats up to 900° C. and up to 1300° C.; expansion coefficients up to 1000° C.; electrical resistivities up to 1300° C.; and thermal conductivities.

Radiography

MICRORADIOGRAPHY. Salkovitz, Edward I., *"Microradiography with Routine X-Ray Equipment,"* METAL PROGRESS, November, 1946, vol. 50, no. 5, pp. 1091-1096.

The author explains how the ordinary radiography unit (x-ray tube with tungsten target) found in most foundries may be used for the study of microstructure of bronzes and other nonferrous alloys, and for the detection of graphite and dendritic structure of iron.

FIRM FACTS

(Continued from Page 67)

Chicago offices of **Hewitt-Robins, Inc.,** have been combined, with the office of Robins Conveyor Div. moving from 37 W. Van Buren St., to that of Hewitt Rubber Div., **7 S. Dearborn St.,** where quarters have been enlarged.

Sully Brass Foundry, Ltd., Toronto, Ont., has been amalgamated with Neptune Meters, Ltd., and will be known as the Sully Foundry Div., of the latter firm.

F. O. Gorman, formerly with Donovan Manufacturing Co., Winona, Minn., and reported in AMERICAN FOUNDRYMAN for December, 1946, as having joined Hirscheimer Foundry Co., La Crosse, Wis., actually is operating his own foundry, Gorman & Co., at La Crosse. He has leased a portion of the Hirscheimer foundry for his new firm's operations.

Iron castings will be produced at Portsmouth, Va., by a new plant, **Portsmouth Foundry Co.,** organized there by G. A. Garber and H. R. Midgett. Although initial production will be in iron, plans call for expansion to include aluminum and brass castings in the near future.

Hydropress, Inc., New York, announces that its **Loewy Construction Co.** has been awarded a contract for the building and erection of a complete metal work and rolling mill installation for India.

The foundry of **Bruce Stewart & Co., Ltd.,** Charlottetown, Prince Edward Island, Canada, was completely destroyed by fire recently. Arrangements for reconstruction have not yet been completed.

Changes occurring within the walls of an electric arc furnace during a heat may now be seen in actual colors, in a picture story produced by **Allegheny Ludlum Steel Corp.,** Pittsburgh, at its Dunkirk, N. Y., plant. The film, "Melting of Huron Die Steel," is one of a series on the story of tool steel from its beginning to the finished product.

In the interest of minimum weight, to facilitate handling, assembly and disassembly operations, magnesium castings (see cut) are used in the new mass chest

x-ray apparatus developed by **North American Phillips Co.,** New York. Production of the unit was undertaken in conjunction with the U. S. Public Health Program, and engineers of the **Eclipse-Pioneer Div., Bendix Aviation Corp.,** Teterboro, N. J., assisted the Phillips firm in the designing.

Garden State Welding Supply Co., 401 Montgomery Street, Jersey City, N. J., has been appointed a dealer in products of **Air Reduction Sales Co.,** New York, and will carry a complete line of that firm's gases, apparatus, electrodes, accessories and supplies, as well as arc welding machines.

Personalities

(Continued from Page 65)

this country as a special exchange student in 1930. He became associated with Alvey-Ferguson Co., Cincinnati, as a machinery designer and advanced to production manager and chief draftsman before joining Cincinnati Milling Machine Co.

J. E. Kendig, a member of the engineering staff of Acme Aluminum Alloys, Inc., Dayton, Ohio, since 1941, was recently named manager of the firm's new Eastern sales division, with headquarters at South Philadelphia, Pa.

E. T. Cuddeback, released with the rank of Lieutenant Colonel after five years service with the Army Air Forces, has joined the Atlanta, Ga., district office of Allis-Chalmers Manufacturing Co.

J. L. Younger, foundry engineer, R. A. Lister & Co., Dursley, England, and **Harold Gustafsson,** supervisor of pattern shops for Wedaverken, a subsidiary of A. B. Bofors, Sweden, were recent visitors to the A.F.A. National Office. Mr. Younger has been inspecting modern foundry installations, with special attention to labor-saving devices employed in castings production by American firms. Mr. Gustafsson, who is on a six-months visit to the United States for the study of pattern manufacturing and modern foundry techniques, is the first recipient of a scholarship award for foundry foremen and supervisors by the American Scandinavian Foundation, which hopes to establish an American-Swedish exchange.

M. B. Olson, formerly Secretary-Treasurer, University of Minnesota Student A.F.A. chapter, and a graduate of the university in mechanical engineering, has joined the jobbing foundry of Aluminum Co. of America, Fairfield, Conn., as an industrial engineer. During the war, Mr. Olson served with the Navy.

E. C. Kron, formerly with Battelle Memorial Institute, Columbus, Ohio, has joined Doehler-Jarvis Corp. as metallurgist in charge of steel and iron activities of the corporation, and will make his headquarters at the Toledo, Ohio, plant.

C. J. Rittinger, formerly chief metallurgist and melting department foreman, Riley Stoker Corp., Detroit, has joined American Car & Foundry Co., of the same city, as foundry engineer. Mr. Rittinger, an active member of Detroit A.F.A. chapter, has been chapter reporter of that group since 1946.

L. B. Thomas, of Pontiac, Mich., who recently completed five months special assignment as a foundry consultant at the Ford Motor Co. River Rouge plant, has

(Concluded on Page 86)

NEW BUEHLER-WAISMAN

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Personalities

(*Continued from Page 85*)

accepted a six months assignment in Puerto Rico, with headquarters at San Juan, as superintendent of foundries for the Sucesores de Abaraca corporation. Mr. Thomas is an active member of the Detroit A.F.A. chapter, and also holds membership in ASM, AIME, ASTM and Society of Automotive Engineers.

Obituaries

Carl O. Thieme, vice-president, H. Kramer & Co., Chicago, died suddenly on December 27, at his home in Chicago.

An active member of Chicago A.F.A. chapter, Mr. Thieme also participated in national activities of the Association in the Brass and Bronze Division, and held membership in several other metallurgical societies. He contributed important assistance in the preparation of the "Manual of Specifications" and other publications of the Non-Ferrous Ingot Metal Institute.

In September, 1945, Mr. Thieme was signally honored with the temporary commission of Colonel, as a member of the Overseas Scrap Advisory Committee.

Mr. Thieme, a native of Salem, Ohio, received his early education at Mansfield, Ohio, and began his career with the Ohio

C. O. Thieme

Brass Co., of that city. Later, he moved to Detroit, where he was associated with the Michigan Smelting & Refining Co., prior to joining the Kramer organization in 1928.

E. Kay Ford, vice-president, Hanna Furnace Corp., Detroit, died January 8 in that city after a brief illness.

Mr. Ford was an active member of Detroit A.F.A. chapter and also held membership in the American Iron and Steel Institute. He was a native of Belleville, Pa., a graduate of Cornell University, and had been associated with the Hanna firm since 1920.

Robert G. George, foundry superintendent, Eberhard Manufacturing Co., Cleveland, and a member of Northeastern Ohio A.F.A. chapter, died on December 9.

Board Meeting

(*Continued from Page 48*)

committees was particularly praised for adding continuously to the strength of the Association.

The Secretary reported on the organization of three new chapters, all west of the Mississippi River, including the Washington chapter, installed at Seattle, December 20, and the Rocky Mountain Empire chapter, installed at Denver, Colo., January 14. The petition for a Tri-State chapter, with headquarters at Tulsa, Okla., was presented and unanimously approved by the Directors, thus bringing the chapter roster to 36 when installation of the latter group has been accomplished.

A.F.A. Research

The Technical Director of A.F.A. reported on several A.F.A.-sponsored research projects, indicating that work on heat transfer is going forward at Battelle Memorial Institute, Columbus, Ohio, as well as at Columbia University, New York. Board approval was given continuation of both projects.

On behalf of the Aluminum and Magnesium Division of A.F.A., the Board was asked to approve a recommendation of the Executive Committee for A.F.A. sponsorship of research work on mechanics of metal flow in molds. This project is reported in more detail elsewhere in this issue and represents the first divisional research project promulgated by an A.F.A. division under the plan for A.F.A.-sponsored research, approved by the Board of Directors at the Annual Board Meeting last July.

Nominations

Director F. J. Walls, as Chairman of the 1947 Nominating Committee, announced the names of candidates for Officers and Directors of the Association, as selected by his committee. The complete slate appears on Page 23.

1947 Awards

Acting in accordance with the A.F.A. by-laws, the Board of Directors unanimously approved the decision of the Board of Awards in

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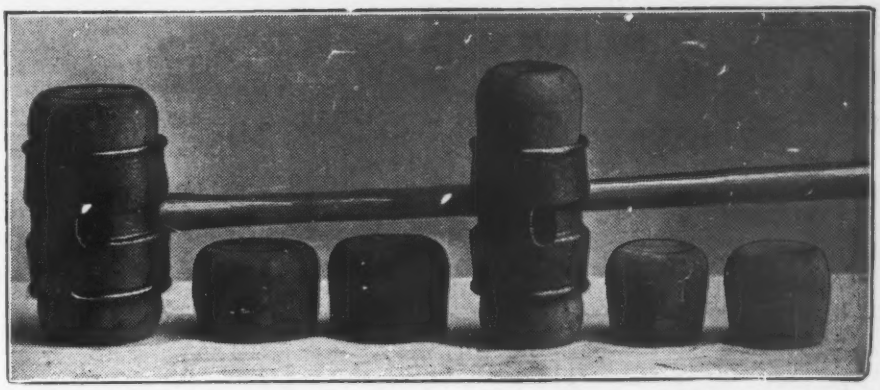

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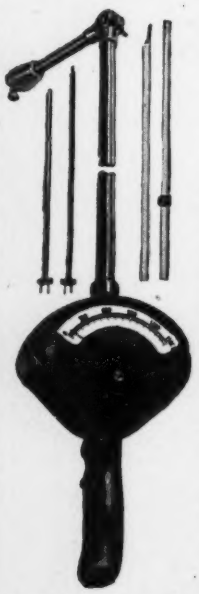

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Board Meeting

(Continued from Page 91)

its selections of the men of the industry who will be honored at the Detroit Convention as the recipients of the Association's gold medals and honorary life memberships. It was announced that these awards would be made at the time of the Annual Banquet, the night of May 1, and full announcement will be published in a forthcoming issue of AMERICAN FOUNDRYMAN.

The report of the Treasurer indicated that the finances of the Association as of December 31, 1946, were in a favorable position for continuing the expansion of A.F.A. activities. The report showed that the Association is operating well within its budget for the current fiscal year.

President Wood reported on recent meetings of the National Castings Council, in which A.F.A. is a participating member, and stated that the Council is continuing its activity on the basis of informal discussions of problems concerning the entire foundry industry.

Meet at Houston

ANNUAL CONVENTION of the American Society of Tool Engineers will be held at Houston, Texas, March 19-22, H. E. Conrad, executive secretary of the society has announced. "This will be the first opportunity to get together our general membership has had since our Annual Convention in Cleveland, last April," he said in anticipating a record attendance of 2,500 tool engineers.

Can You Help?

In view of a number of recent references, A.F.A. is interested in obtaining for its technical library a copy of the book, *History of the Manufacture of Iron in All Ages*, by James M. Swank, published by the author in 1884.

If you have available a copy of this volume, please write to: The Secretary, American Foundrymen's Association, 222 W. Adams St., Chicago 6.

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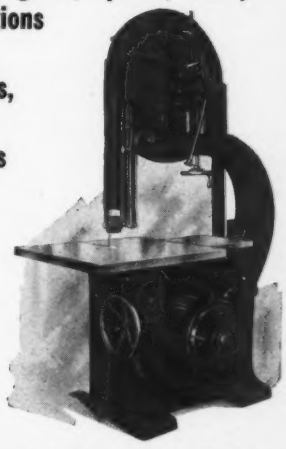

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